USDA
Remote Sensing Overview
JACIE 2012

April 17, 2012

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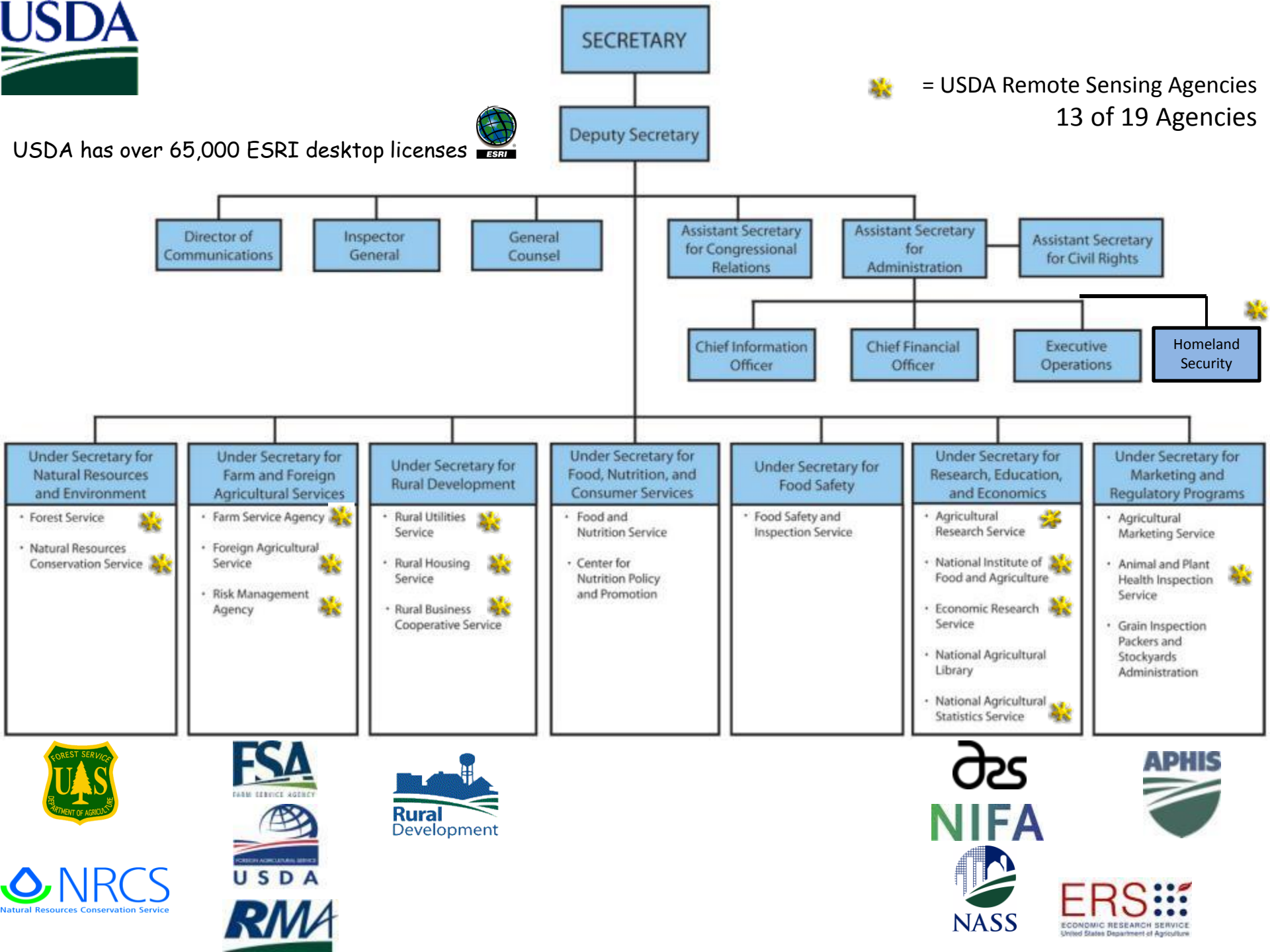
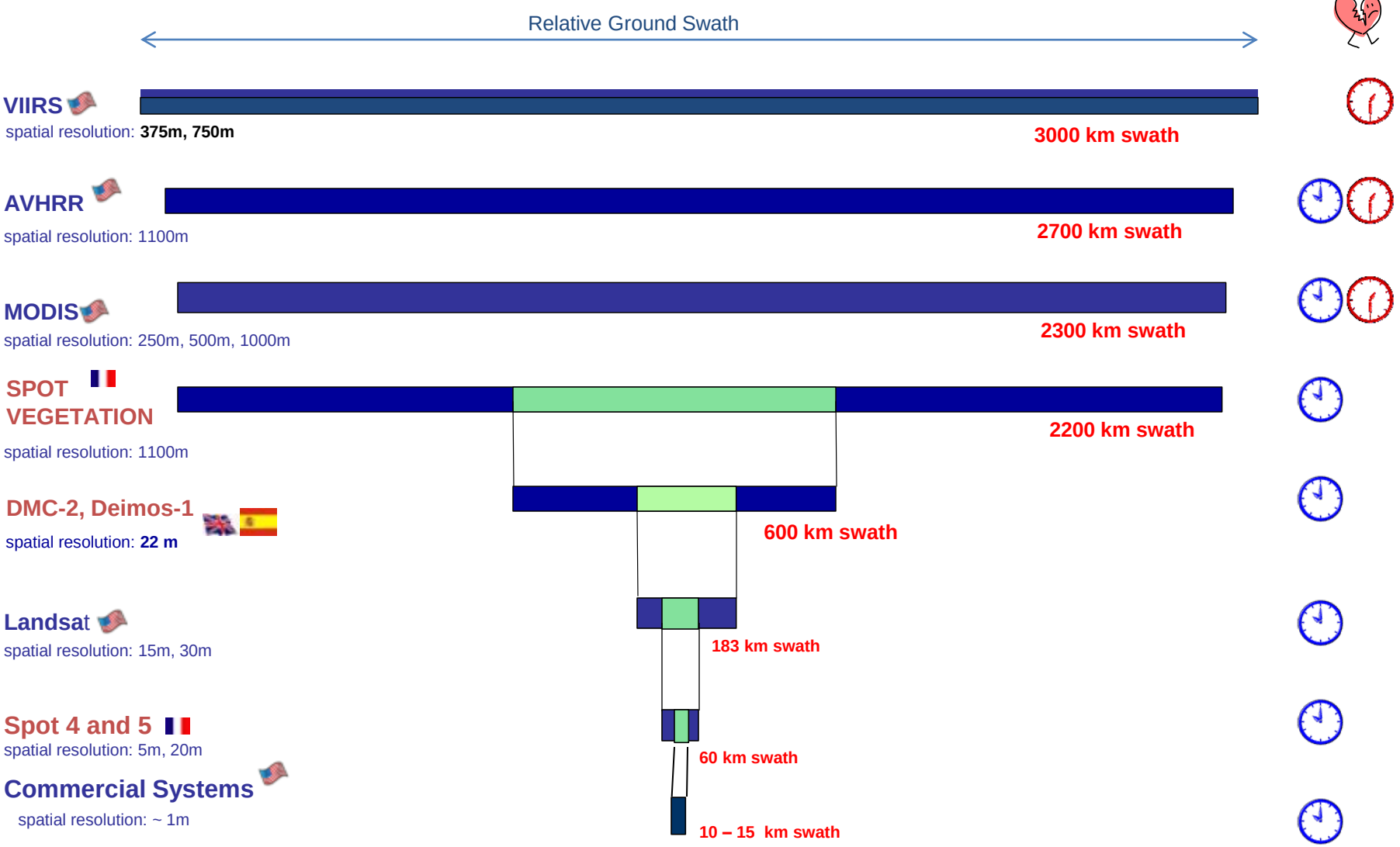

USDA
= USDA Remote Sensing Agencies
13 of 19 Agencies
USDA has over 65,000 ESRI desktop licenses
ESRI
SECRETARY
Deputy Secretary
Director of Communications
Inspector General
General Counsel
Assistant Secretary for Congressional Relations
Assistant Secretary for Administration
Assistant Secretary for Civil Rights
Chief Information Officer
Chief Financial Officer
Executive Operations
Homeland Security
Under Secretary for Natural Resources and Environment
Forest Service
Natural Resources Conservation Service
Under Secretary for Farm and Foreign Agricultural Services
Farm Service Agency
Foreign Agricultural Service
Risk Management Agency
Under Secretary for Rural Development
Rural Utilities Service
Rural Housing Service
Rural Business Cooperative Service
Under Secretary for Food, Nutrition, and Consumer Services
Food and Nutrition Service
Center for Nutrition Policy and Promotion
Under Secretary for Food Safety
Food Safety and Inspection Service
Under Secretary for Research, Education, and Economics
Agricultural Research Service
National Institute of Food and Agriculture
Economic Research Service
National Agricultural Library
National Agricultural Statistics Service
Under Secretary for Marketing and Regulatory Programs
Agricultural Marketing Service
Animal and Plant Health Inspection Service
Grain Inspection Packers and Stockyards Administration
FOREST SERVICE
US
DEPARTMENT OF AGRICULTURE
FSA
FARM SERVICE AGENCY
Rural Development
ars
NIFA
APHIS
NRCS
Natural Resources Conservation Service
USDA
RMA
NASS
ERS
ECONOMIC RESEARCH SERVICE
United States Department of Agriculture

USDA Agricultural Monitoring Satellites

VIIRS Degraded Capacity from MODIS era.

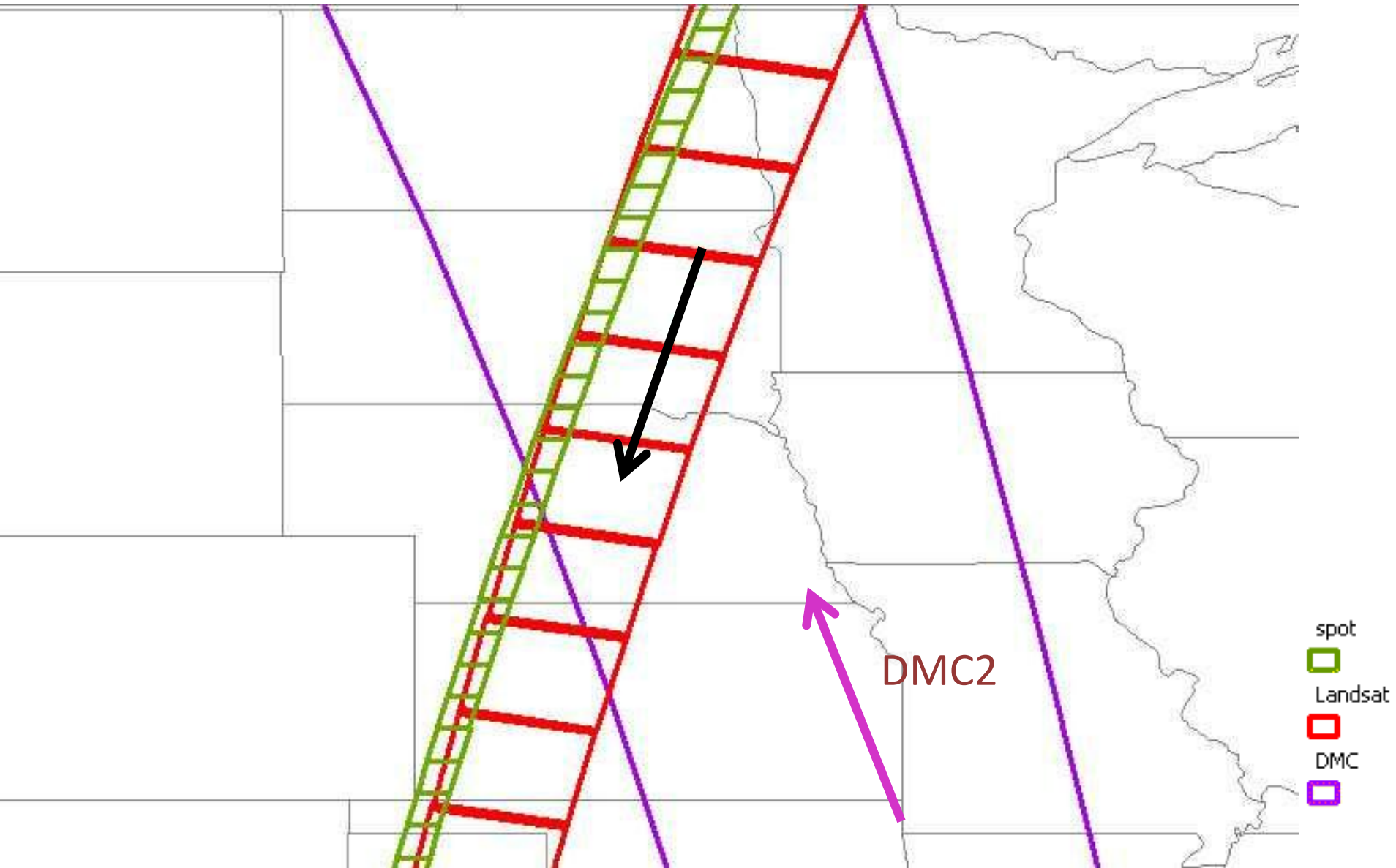


USDA agencies use imagery for many operational tasks. Major applications include:

- Disaster Response and Recovery
- Compliance (Crops, Conservation, Forestry)
- Monitoring US and Global Agricultural Production
- Forest Monitoring (Health and Inventory)
- Forest Carbon Stocks and Fluxes
- Burned Area Emergency Response (BAER)
- Conservation Programs
- Pest Management
- Mapping




DMC2, SPOT, and Landsat Swaths:
Wide Swaths are better for Monitoring and Classification



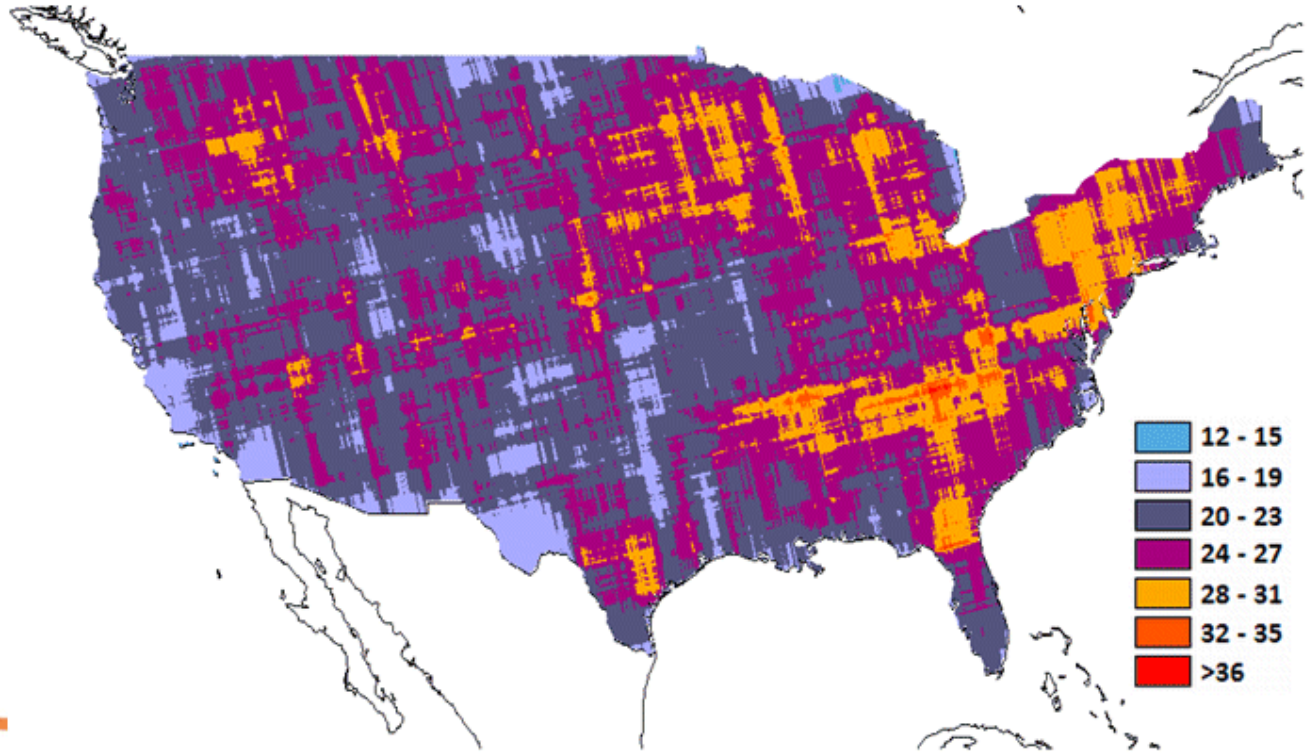
USDA Commercial Satellite Imagery Acquisitions

- The USDA Satellite Image Archive is the USDA focal point for Mid resolution imagery acquisitions.
- 2011 and 2012 Funded DMC 2 Acquisitions and SPOT Cost Share with USGS.
- Increasing operational use / dependability of image acquisitions with the use of 5 satellites US Monitoring: Landsat 7, Deimos-1 (Spain) + UK2 form (UK) and Spot 4 and 5.

Temporal Coverage

- Maximum coverage 36 times
- 100% - covered 12 times
- 45% - covered 20 -23 times

USDA Acquired DMC2 Coverage for Crop year 2011
Increase Spatial and Temporal Resolution

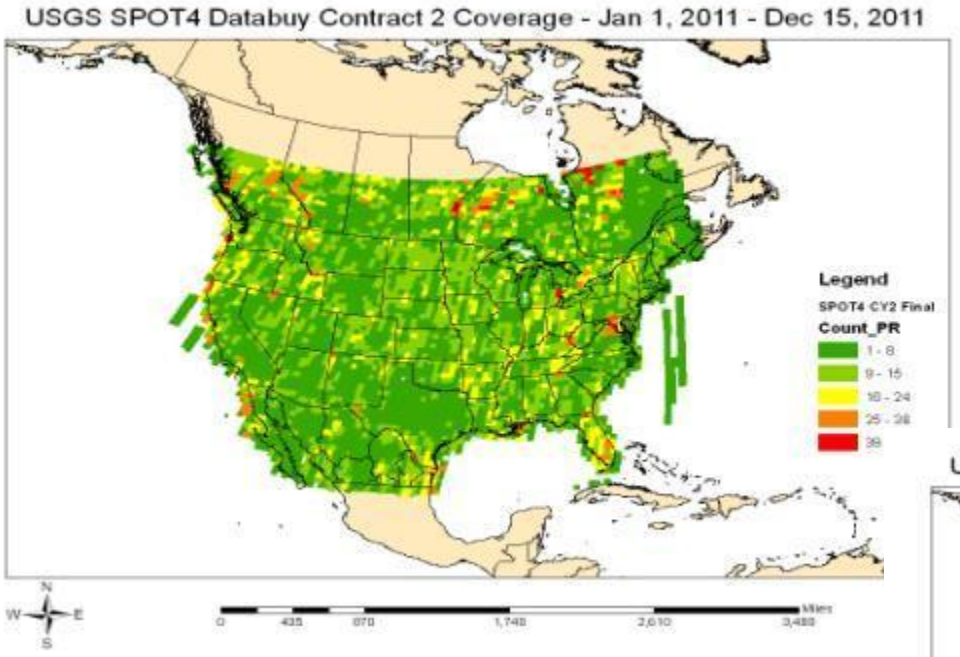


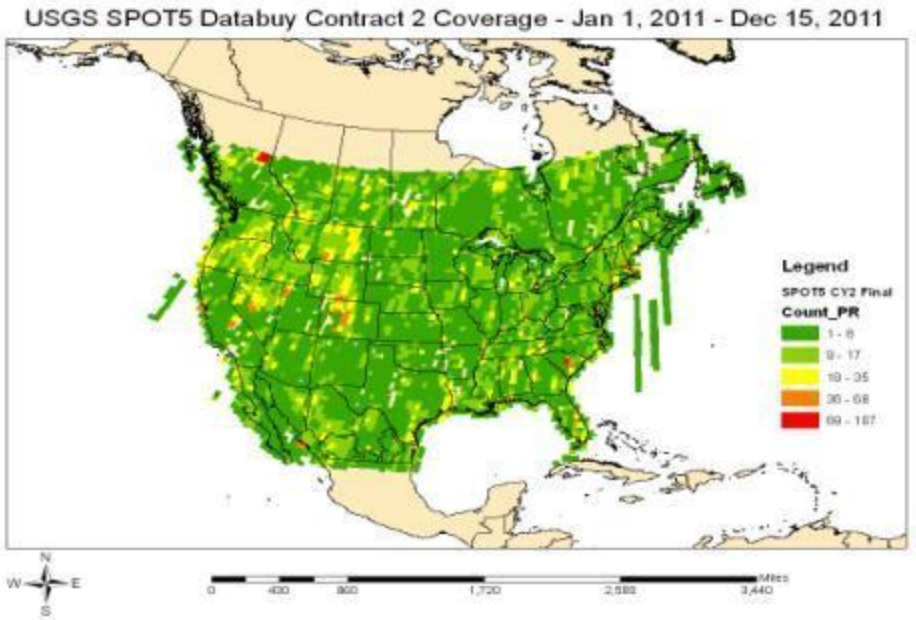
USDA
All the space you need

Status Graphic used with permission of Astrium
Additional content added.

ASTRIUM
AN EADS COMPANY

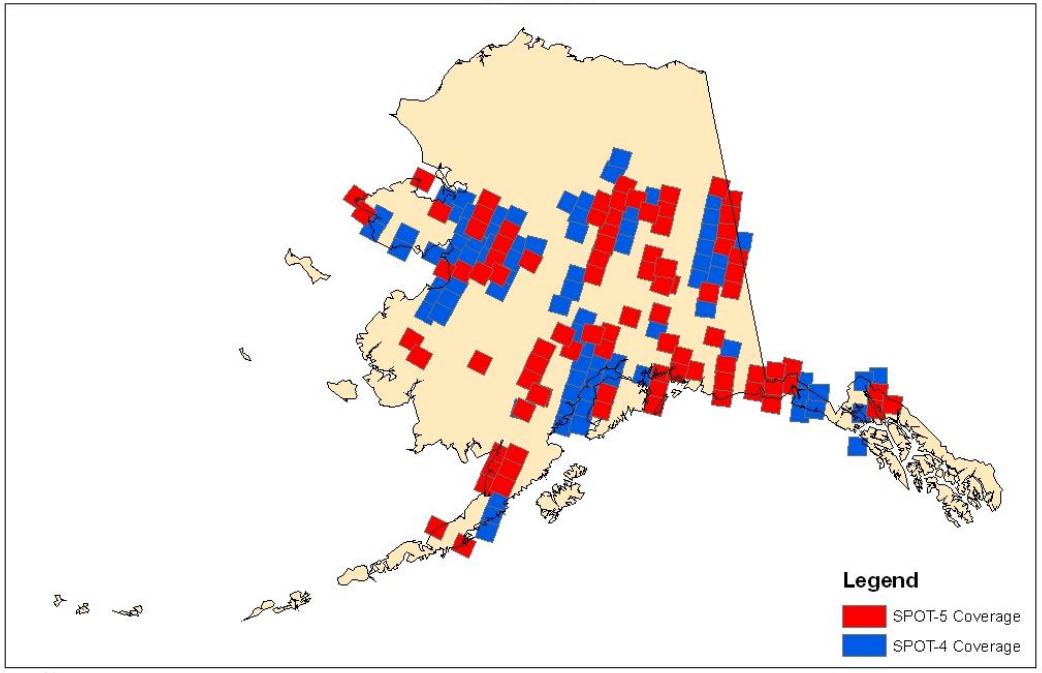
USDA Cost Shares with USGS on SPOT data Buy to Increase Spatial and Temporal Resolution

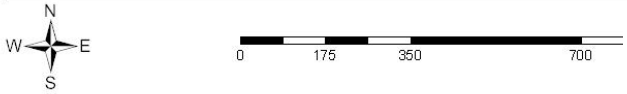




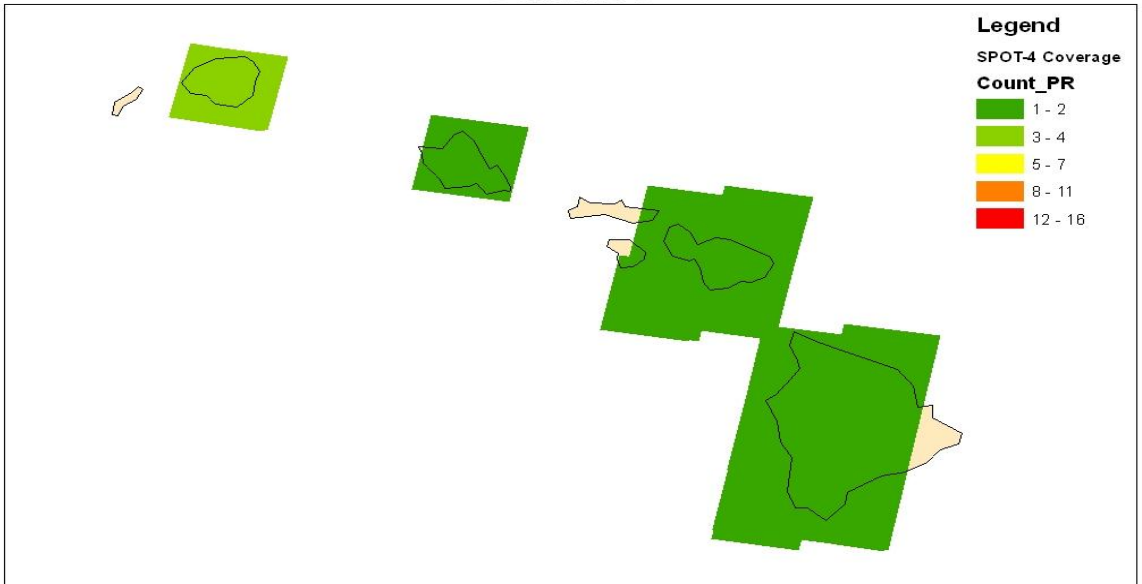
Take Away: USDA Exploits a great deal of imagery, most of which is from foreign sensors.

USGS SPOT - 4 & 5 Databuy Alaska Coverage March 2012
Contract 3





USGS SPOT - 4 Databuy Hawaii Coverage Dec 16, 2011 - Feb 29, 2012
Contract 3



USDA Farm, Insurance, and Conservation Program Building Blocks

Over **35 million Common Land Unit (CLU)**Polygons representing over **5 million Farms**
+ Crop Reporting
All CLUs have been owner certified.

National Agriculture Imagery Program (NAIP) Imagery every 2 years

Area of area planted and crop types.

Farm, Conservation, Disaster, and Insurance Programs are Administered at the CLU level.

FSA FARM SERVICE AGENCY

NASS

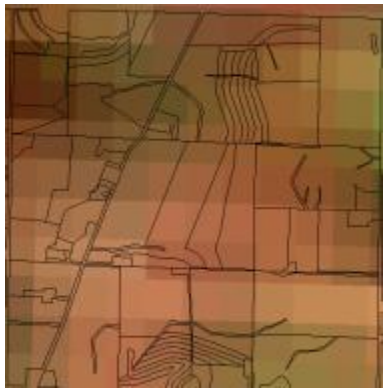
RMA

NRCS Natural Resources Conservation Service

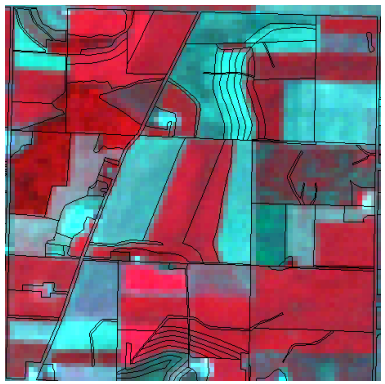
APHIS

Pixel Size Matters!

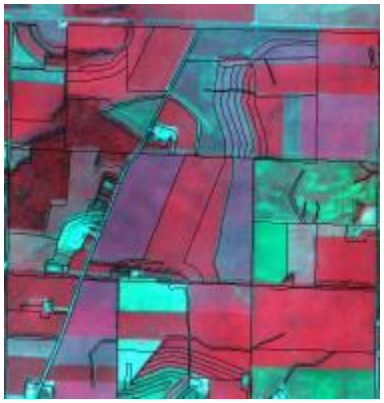
Common Land Units (CLUs):
A farm is made up of one or more CLUs



1 MODIS pixel to many CLUs
Even more CLUs per VIIRS pixel



Many Landsat pixels per 1 CLU
(not true everywhere)



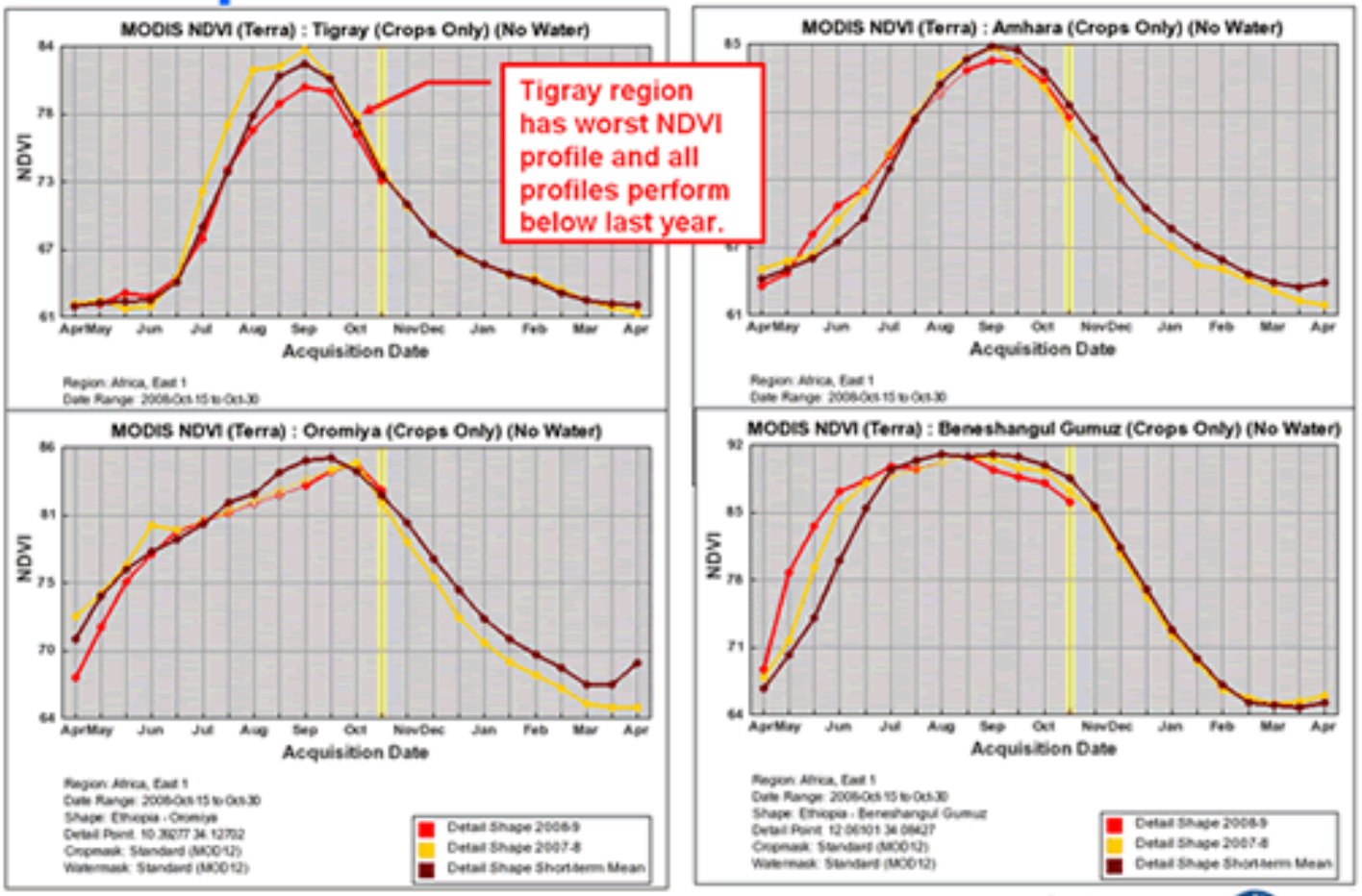
More SPOT pixels per 1 CLU

- As pixel size decreases, more CLUs will have many to one relationship. Land Remote Sensing program should look at moving to 10 to 20 meter pixels.

- The VIIRS era is moving in the wrong direction relative to MODIS.

Time Series Imagery Critical to Crop Monitoring. Indices Profile by CLU, County, or State

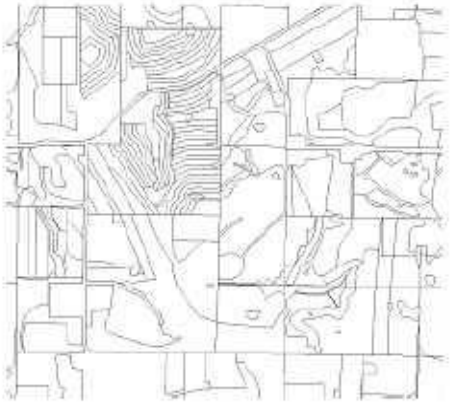
Cropland MODIS-NDVI Time Series



Data Source: http://pekko.geog.umd.edu/usda/demo1/

Linking U.S. Agriculture FAS to the World

Where, When & What's Going on?



Common Land Unit (CLU)
Owner/operator
Delineated from permanent features
Linked to:
Crop History (Reported Yields)
Reported Crops

1 meter Imagery (NAIP)
Updated Base
Yearly Compliance

Basis for Reporting / Claims / Compliance / Updates

Time Series Imagery
Continual Monitoring

Fields targeted for further analysis

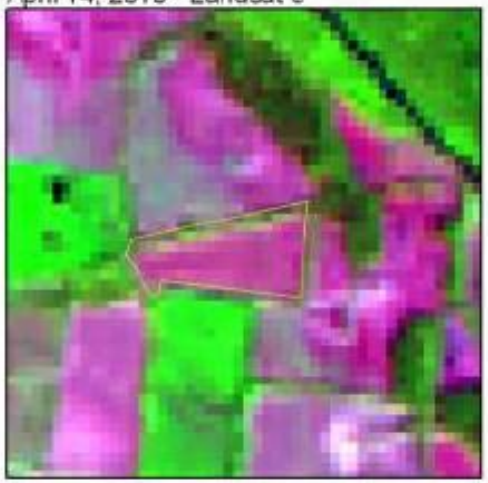
Compliance/Large Claim
Forensic Remote Sensing

- The study and interpretation of remote sensing (aerial photography and many sources of satellite imagery) evidence
- Techniques:
  - Identify presence/absence of crop
  - Verify crop type
  - Verify producer reported information (planting date, harvest date, cause of loss)
  - Reconstruct crop histories from available satellite imagery and aerial photography
  - …

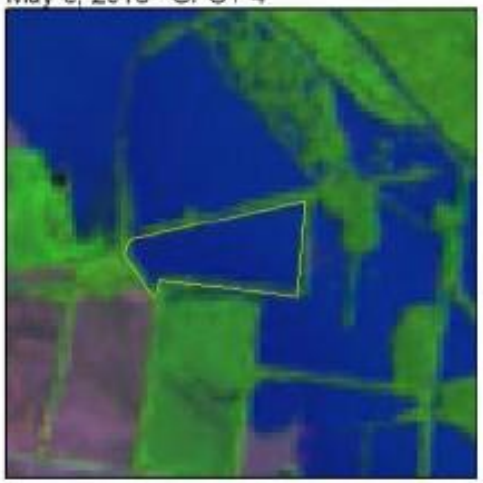
By Combining Multiple Sources of Imagery, RMA can Understand Past Conditions.

2008 FSA NAIP Aerial Photography

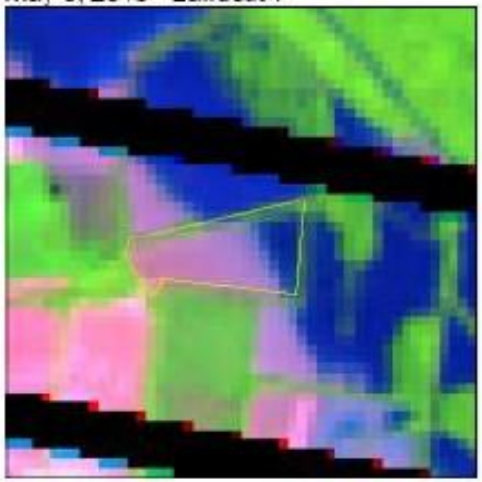
April 14, 2010 - Landsat 5



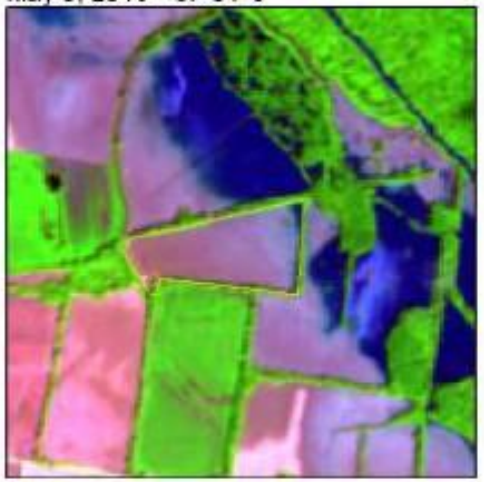
May 3, 2010 - SPOT 4



May 8, 2010 - Landsat 7



May 9, 2010 - SPOT 5



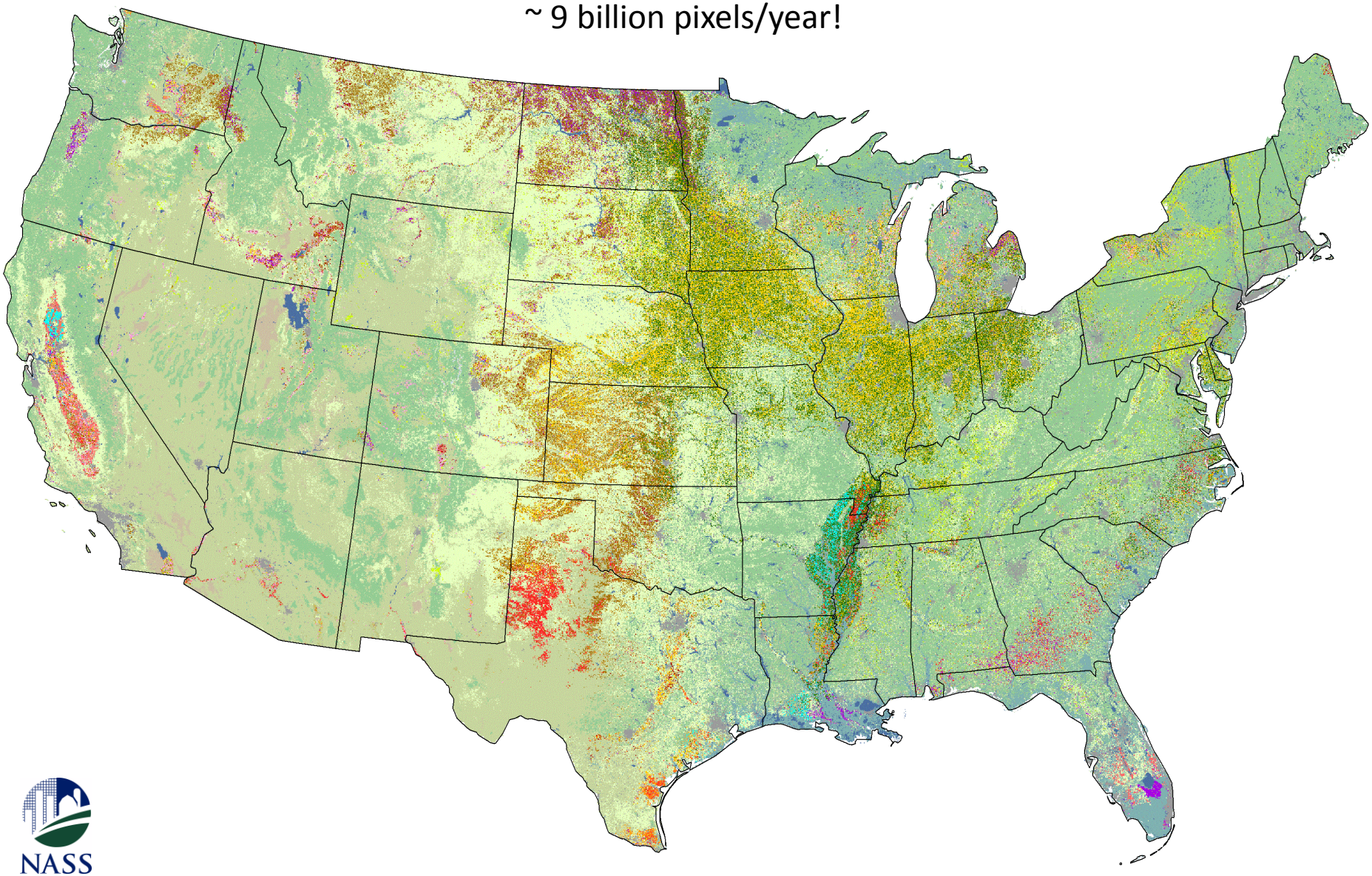
June 1, 2010 - Landsat 5

RMA

Actionable Information

2008 – 2011 National Cropland Data Layers

~ 9 billion pixels/year!



NASS

2010 Cropland Data Layer
McLean County, IL

NASS

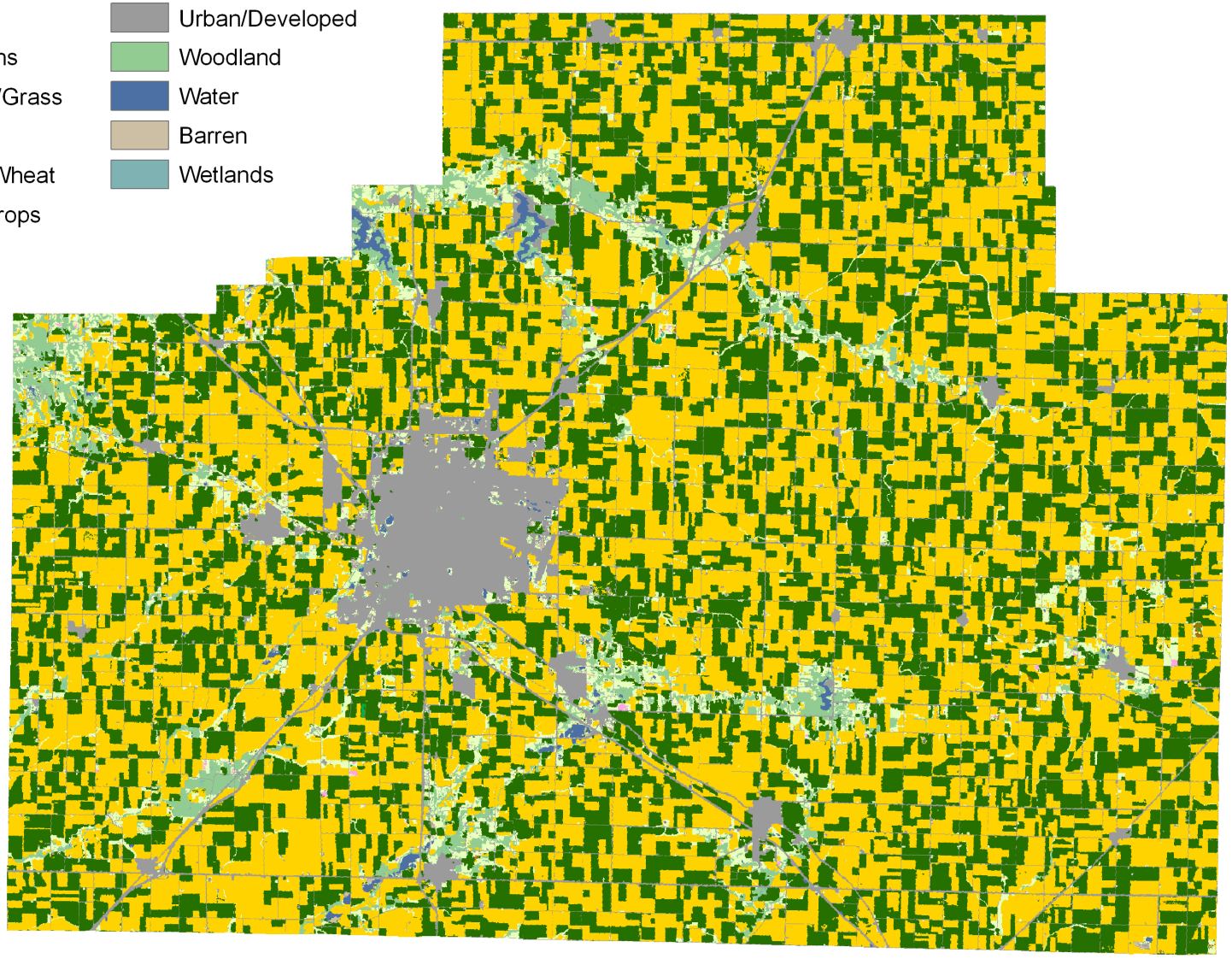
Land Cover Categories
(by decreasing acreage)

Agriculture

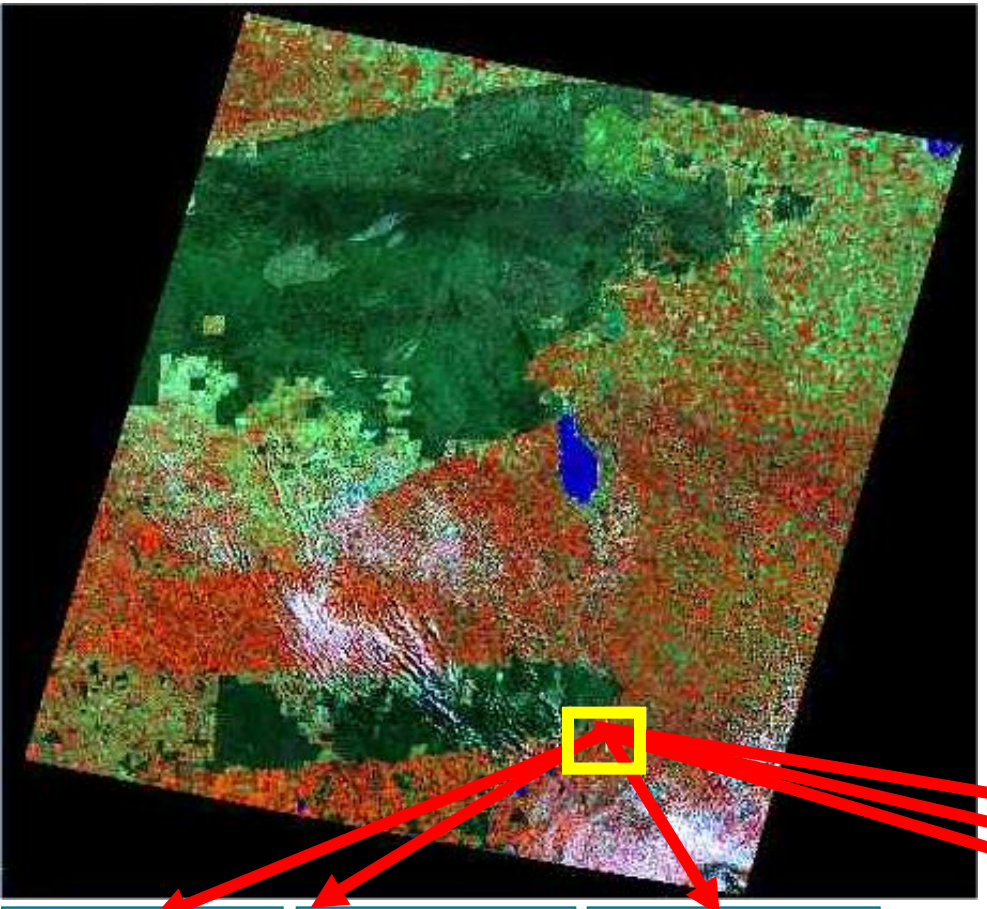
- Corn
- Soybeans
- Pasture/Grass
- Alfalfa
- Winter Wheat
- Other Crops

Non-Agriculture

- Urban/Developed
- Woodland
- Water
- Barren
- Wetlands



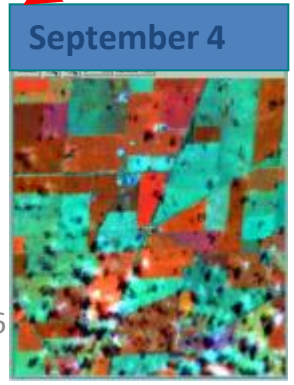
Crop Identification and Crop Stage Determination with Mid-Resolution Imagery

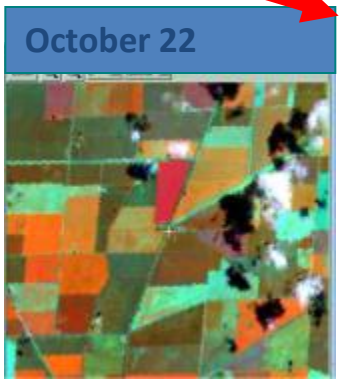


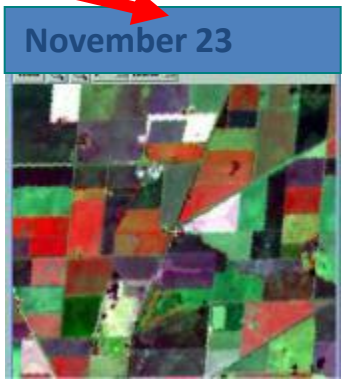
Satellite Data Over Important Agricultural Regions
Canola

Victoria, Australia

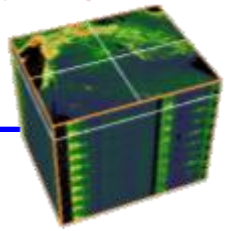
Field-Level Time-Series Analysis Using Landsat TM Satellite complements the MODIS Time Series Acquisitions.



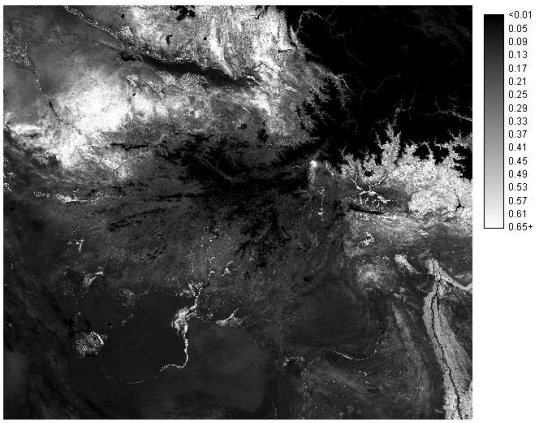




Time Series NDVI Differencing

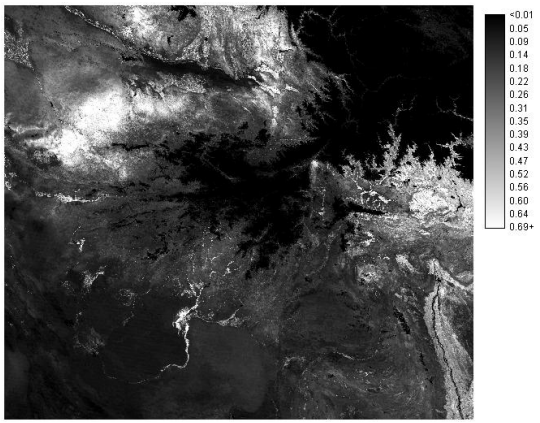


NDVI Image T_1



Current NDVI

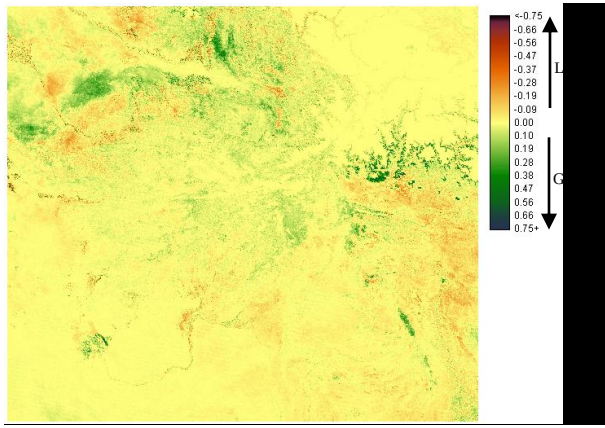
NDVI Image T_2



Past NDVI

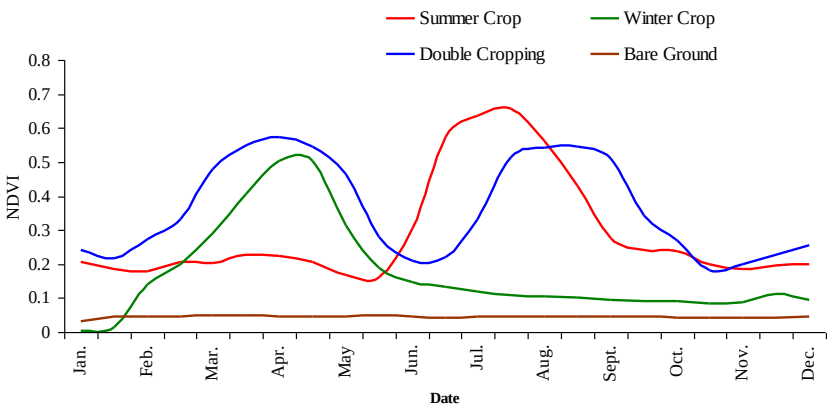
- Previous year
- Average of previous years
  - (3yr, 5yr, 10yr…)
- Same year, previous month

NDVI Change



Mask Change by:

- Irrigation
- Crop
- Ag / not Ag



Take away: If we only attempt to acquire data every 16 days, it is easy to important crop stages from cloud cover. Unreliable data acquisitions create a operational use gap.

USDA

USDA Aerial Programs

National Agriculture Imagery Program (NAIP)

National Resources Inventory (NRI)

Forest Service Resource Photography

Stewardship Lands Photography

USDA Farm Service Agency (FSA) APFO

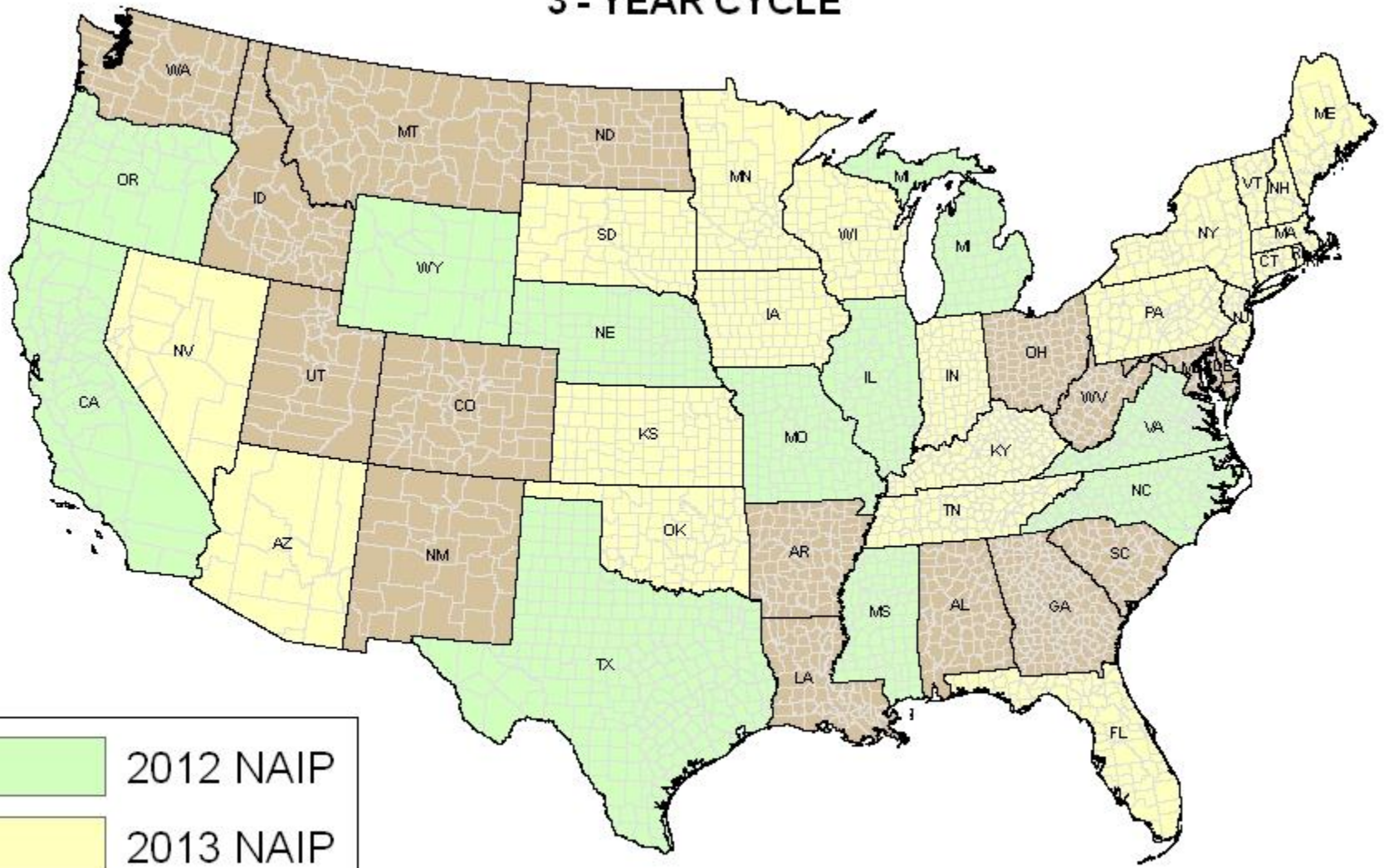
- For all USDA Major Aerial Acquisitions USDA/FSA/Aerial Photography Field Office (**APFO**)
  - Contracts
  - Quality Controls
  - Archives

*www.**apfo**.usda.gov*

FSA
FARM SERVICE AGENCY

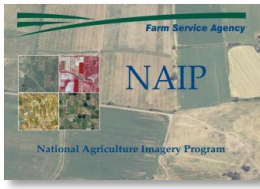
2012 - 2014 NAIP ACQUISITION

3 - YEAR CYCLE



USDA-FSA-APFO

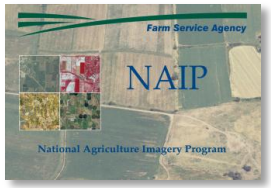
New NAIP IDIQ Contract



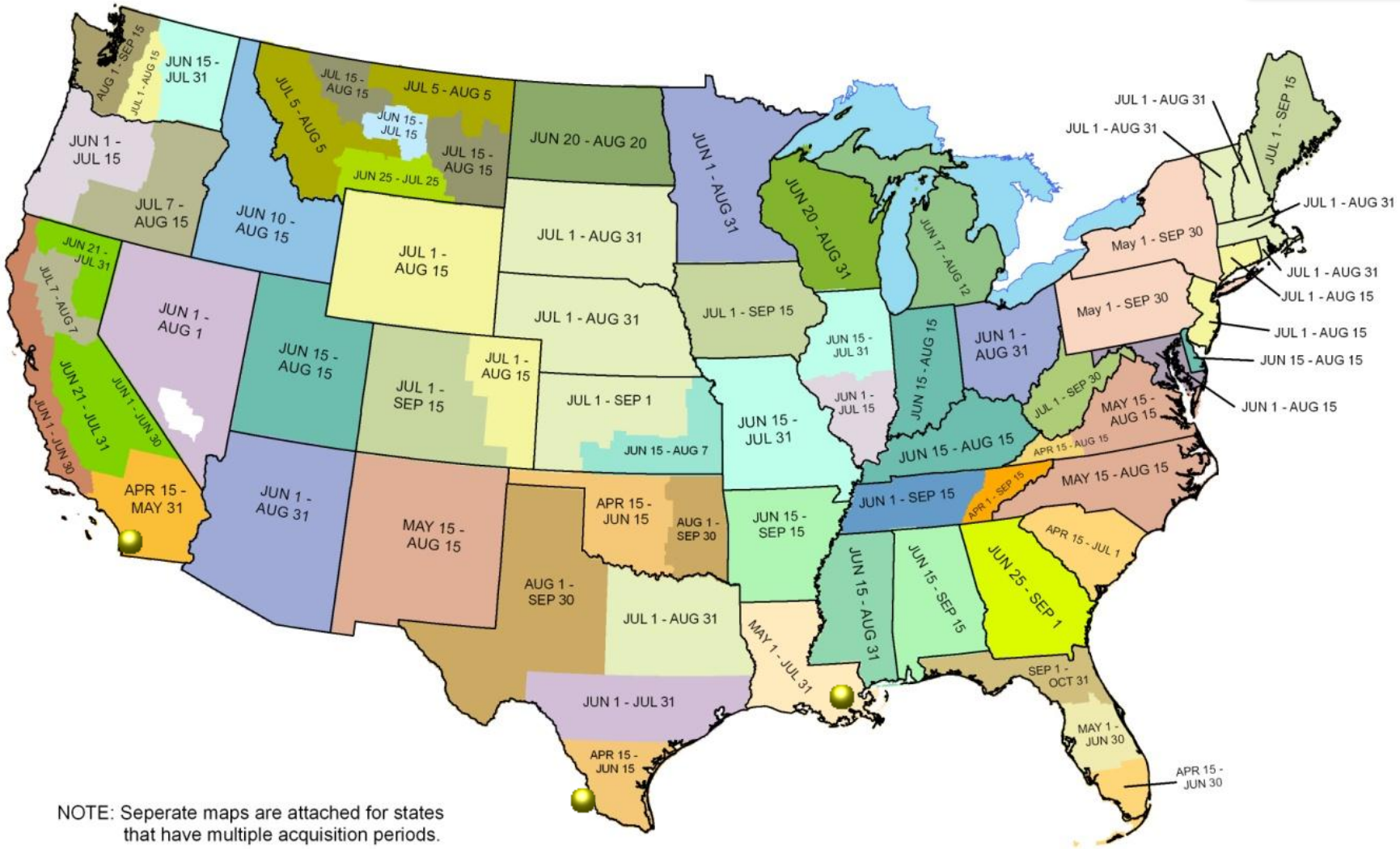
- **Scheduled to be awarded April 2012**
- **Contract length – Single year with 4x 1 yr ext**
- **Standard Product:**
  - 4-Band GeoTIFF DOQQ ← 4-Band = Must be acquired using digital sensor
  - 1m GSD resolution
  - State-based seamline shapefile
- Optional or alternative award items that may be considered include, but are not limited to:
  - ½ meter resolution imagery buy-up
  - stereo imagery
  - digital elevation model update or creation
  - spectral imagery of more than 4-bands
  - web image services

2012 NAIP Delayed by a Solicitation Protest

- The NAIP solicitation was protested. This delayed contract awards.
- The NAIP solicitation protest was dismissed on April 12.
- Delayed the start of source selection and negotiations until April 13.
- Projected date of award: Early May.
- Fly season scheduled to start April 15.
- Actual start of fling season TBD.



2012 NAIP ACQUISITION PERIODS



NOTE: Seperate maps are attached for states that have multiple acquisition periods.

● = 2012 Planned Areas Impacted by Protest

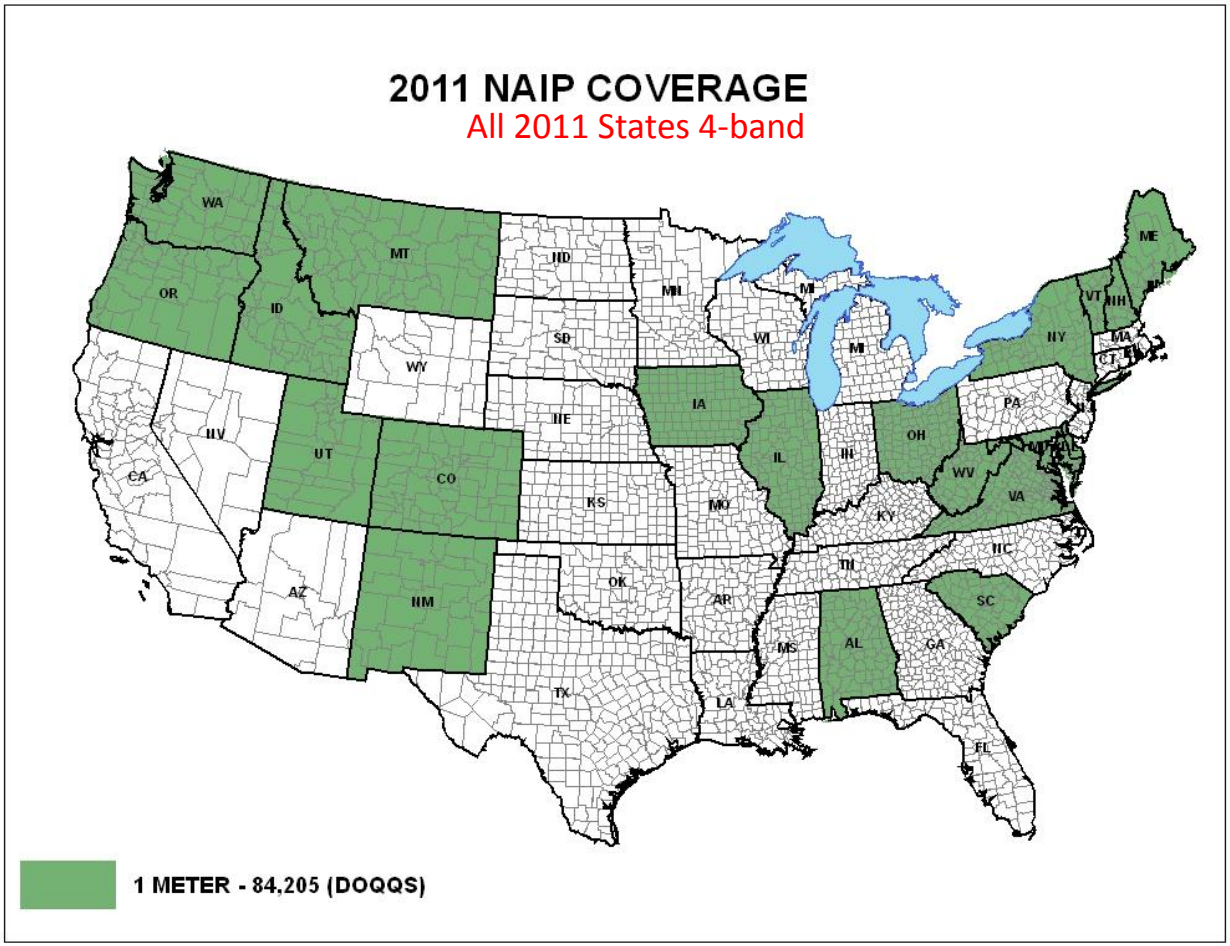
USDA-FSA-APFO

2012 Partnership Agreements

- 2012 budget is estimated at $15.8M

FSA	$10.1M	USDA	88%
NRCS	$1.9M	DOI	12%
FS	$1.9M		
DOI	$1.9M		

FY2011 APFO Contracting Summary



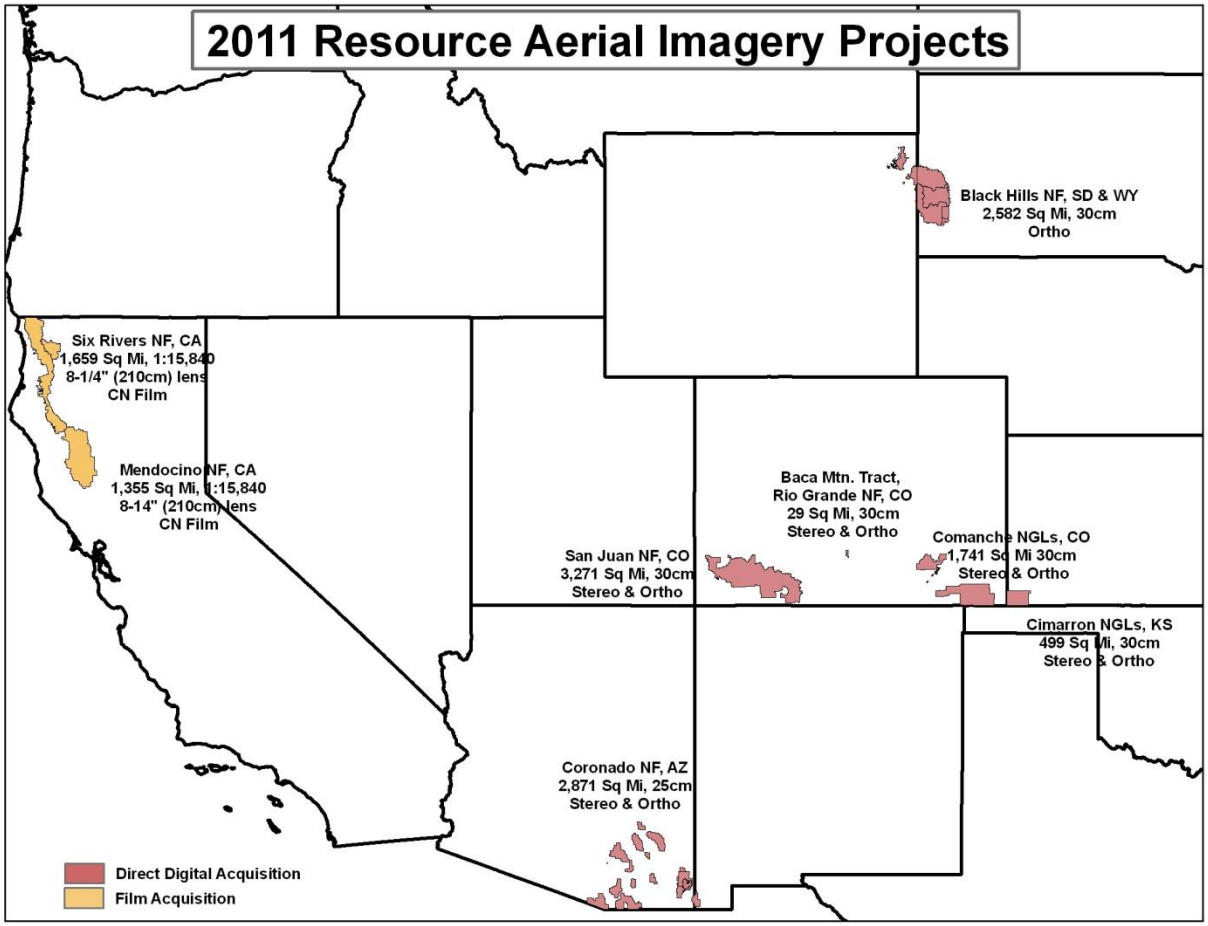
National Agriculture Imagery Program (NAIP): Awarded contract task orders for one meter, 4-band, digital orthoimagery covering 1,175,517 square miles in 20 states, for a total contract value of $16,454,443.63. 2011 was the final year of a 5 year IDIQ contract

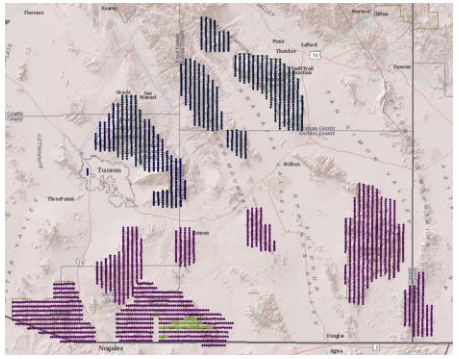
Forest Service Resource Photography

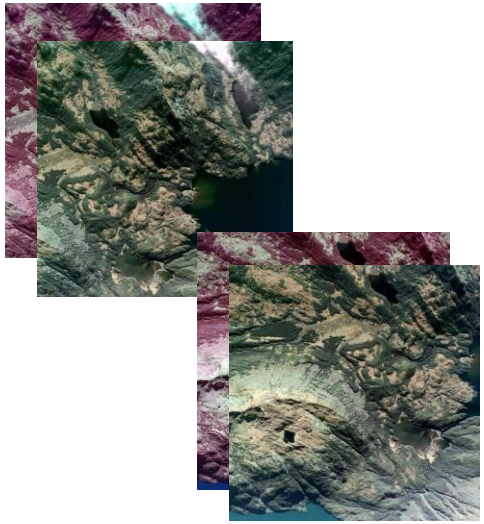
- Pike-San Isabel & Rio Grande National Forests

6,964 Square Miles
13,018 Stereo Images
13,018 Ortho Images

FY2011 APFO Contracting Summary

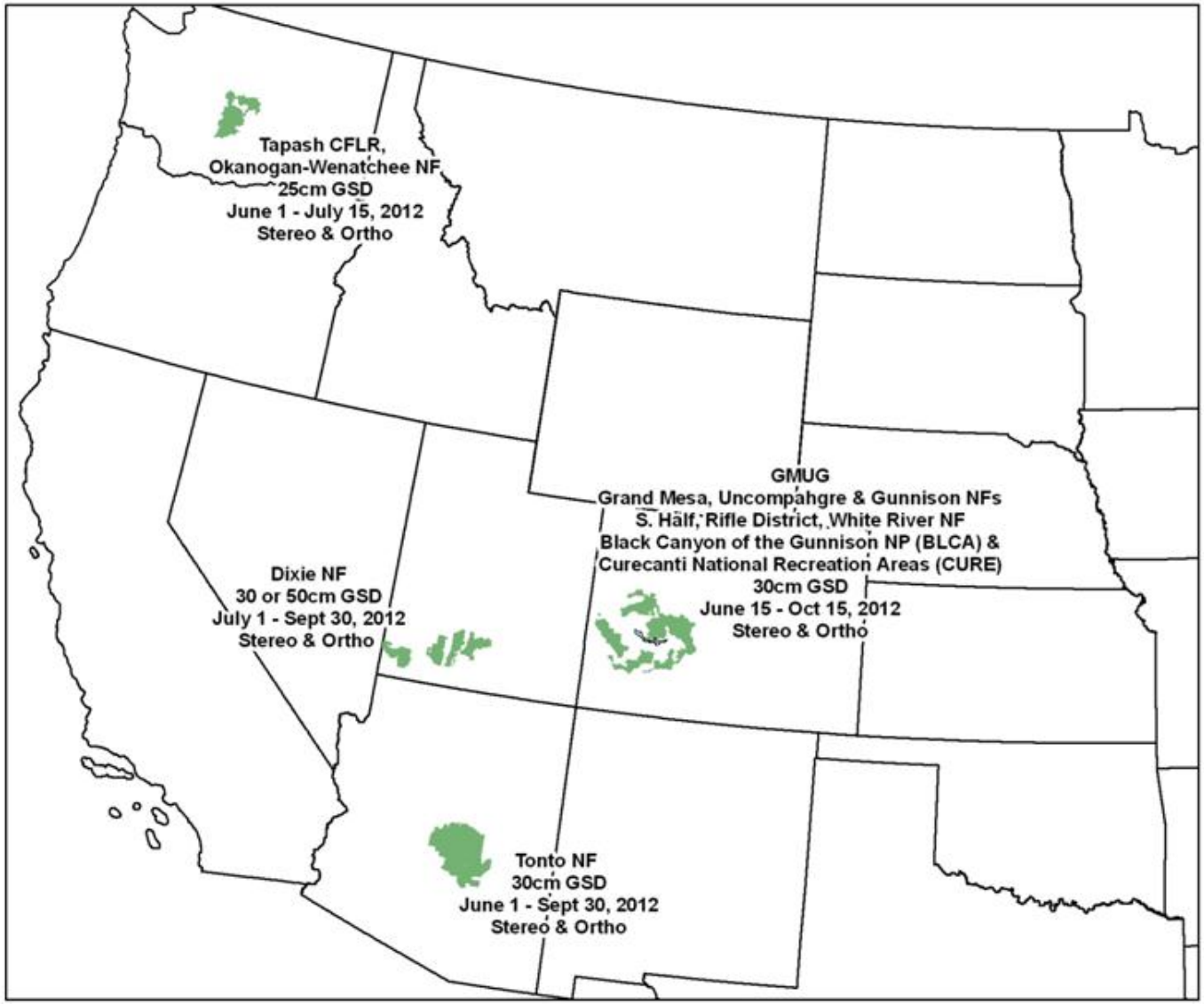






USFS Resource Aerial Photography Contracts: Contracted for 8 USFS resource projects **(6 digital & 2 film)** covering 14,827 square miles of national forest system land, for a total value of $628,969.38.

Planned 2012 Resource Contracts*



25-50 cm GSD Digital 4 band Collections: Deliveries of Orthophotos and Stereo Coverage

* Subject to availability of funds.

Evolution of Digital Stereo Resource Photography

The Forest Service has a long history of using film based stereo imagery to monitor forests.

Digital imagery allows meet multiple requirements to be satisfied with the same acquisition:

- High Spatial Resolution (1 foot or less) ortho image base updates
- 4-band imagery exploitation
- Stereo exploitation

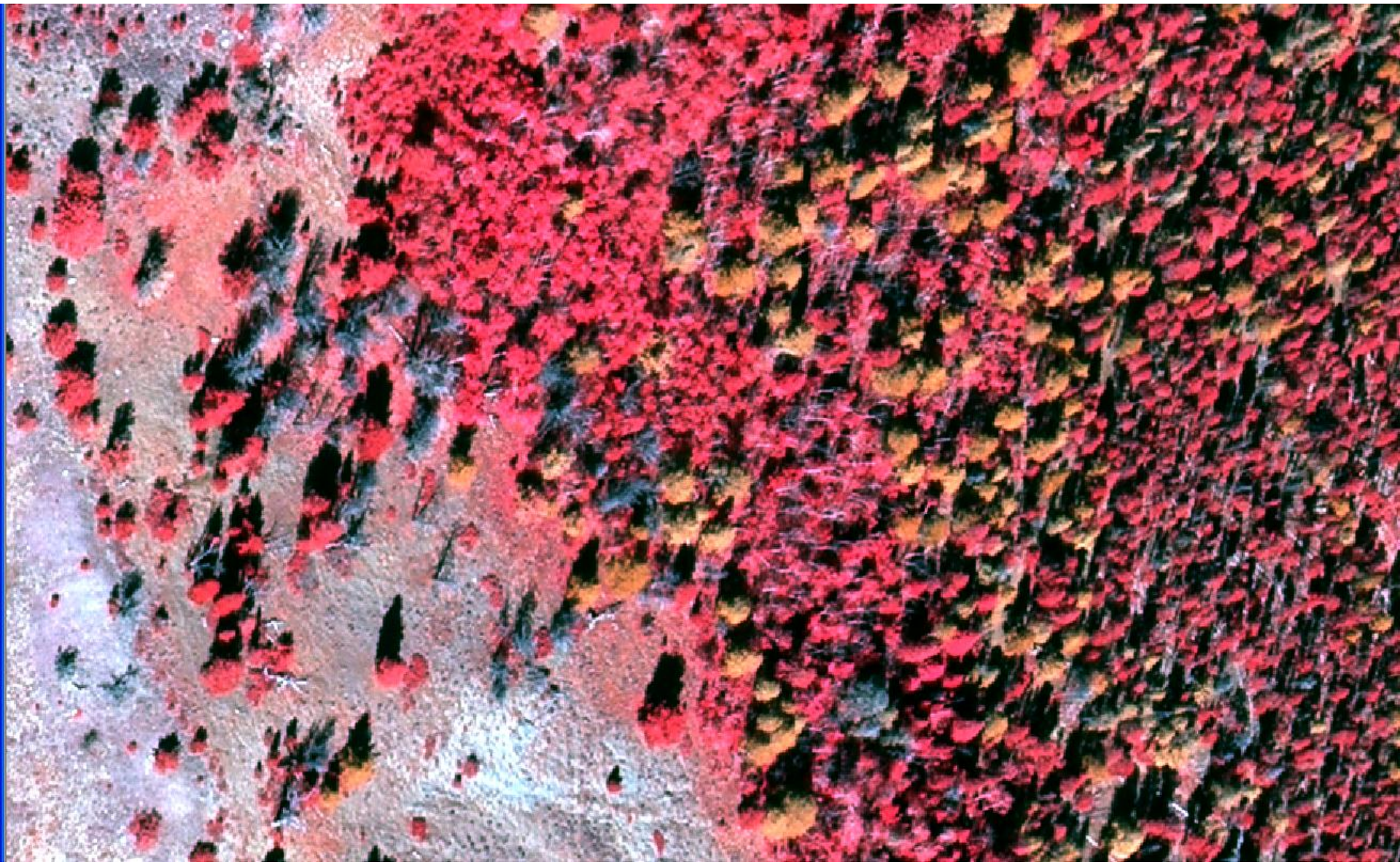
Chronology:

- **2007**: the Forest Service started to fly high resolution digital imagery for forests.
- **2008** and **2009**: several forests were flown with 1-foot, 4-bands, 16-bit, stereo coverage.
- **2010**: forests were flown with 1-foot, 4-bands, 16-bit, stereo coverage with full resolution DOQQQ and compressed DOQ mosaics.
- **2012**: forests to be flown with 25-50 cm GSD, Digital 4 band, Orthophotos and Stereo Coverage

Problems:

- Large File Sizes (disk space and network constraints)
- Acquiring new Hardware and Software to support softcopy stereo exploitation
- Each product requires quality control (Ortho, Stereo, Frame, and Mosaic)

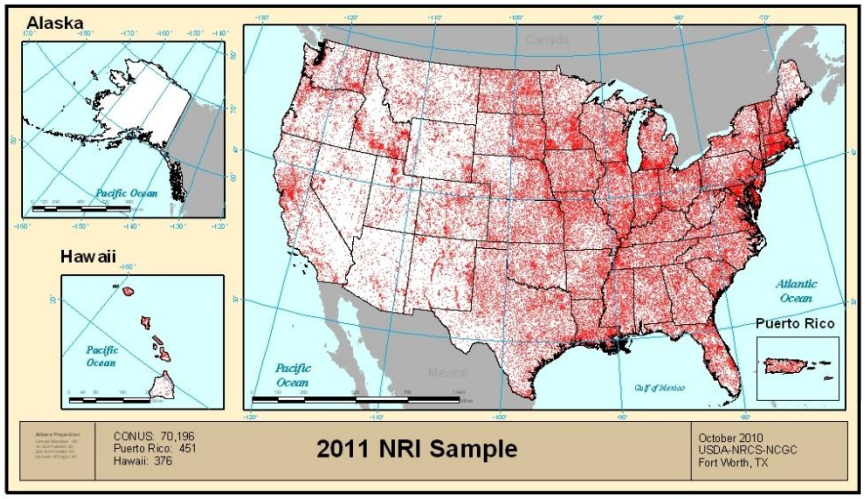
Dead (silver) and dying red/brown trees affected by the Mountain Pine Beetle epidemic. FS needs to evaluate individual trees. (Natural Color)

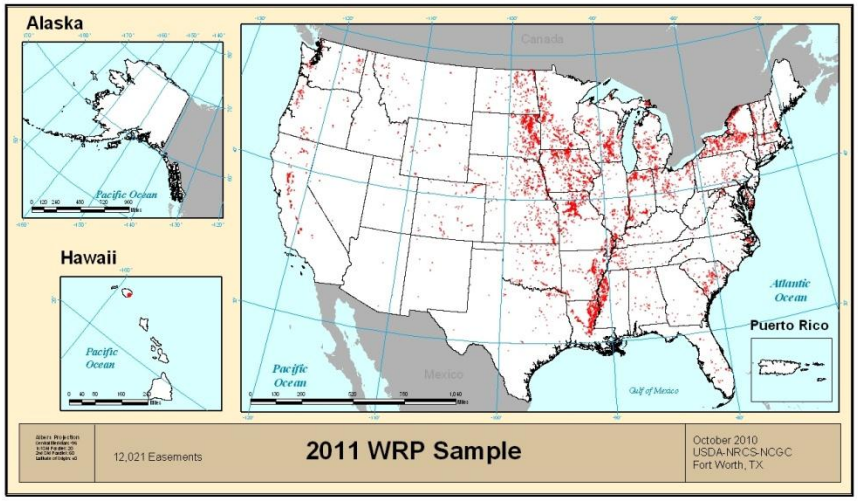


Dead (silver) and dying yellow trees affected by the Mountain Pine Beetle epidemic. (CIR)

Digitizing erosion hazards along Trail Creek inside the Hayman Burn (2002) using 2010 stereo imagery and a Planar 3D mirror display.

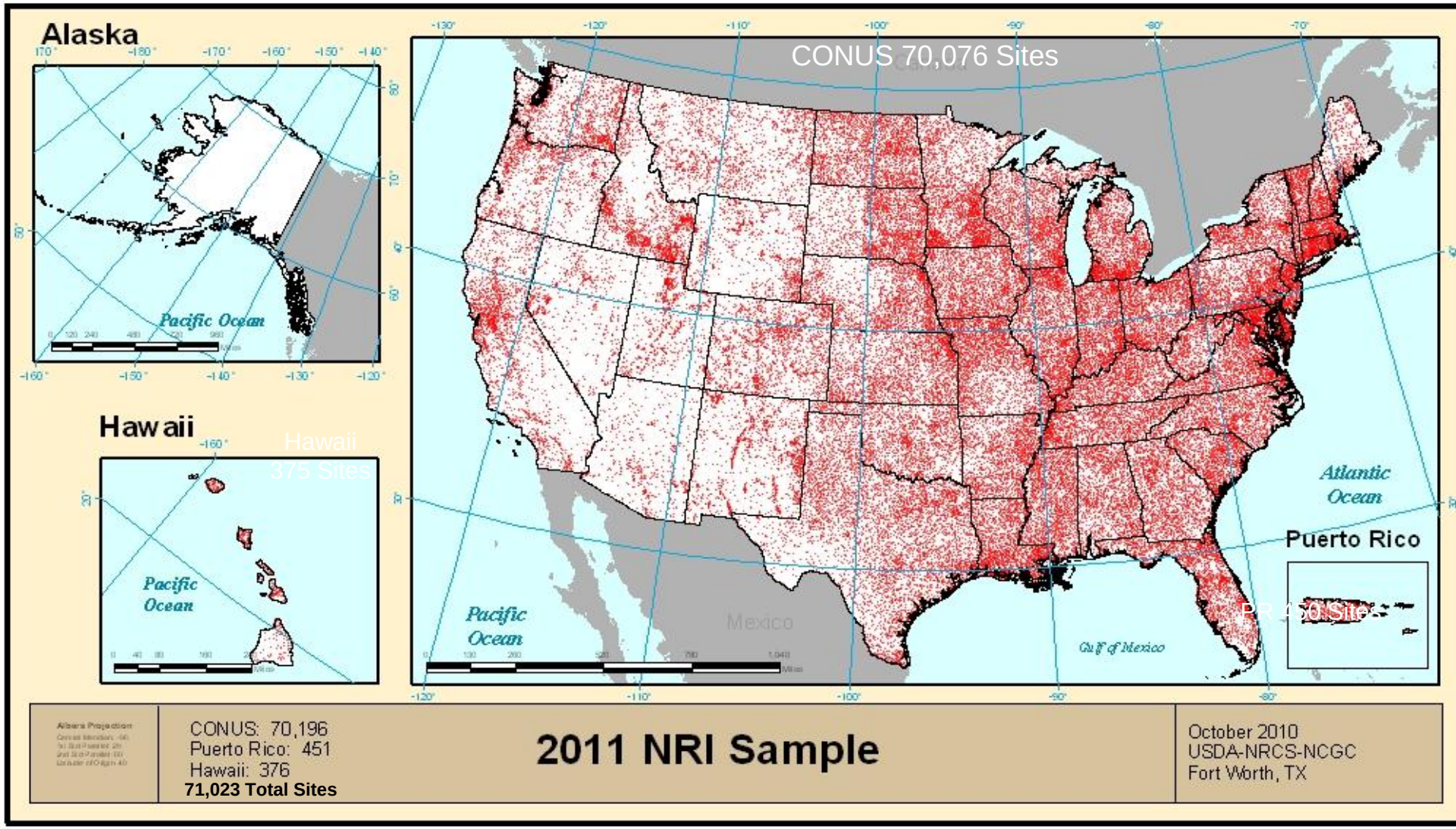
National Resource Inventory (NRI) and Stewardship Lands Imagery





National Resource Inventory (NRI) and Stewardship Lands Imagery (WRP) Contracts: Awarded contract task orders for 91,507 sites and easements in the lower 48 states, Hawaii, and Puerto Rico & Virgin Islands, for a total contract value of $8,891,479.35. A combined total administrative charge of $266,744.38 was assessed. 2011 was the first year of a two year IDIQ contract. NRI and SLI imagery support the mission of NRCS programs.

2011 National Resource Inventory Sites

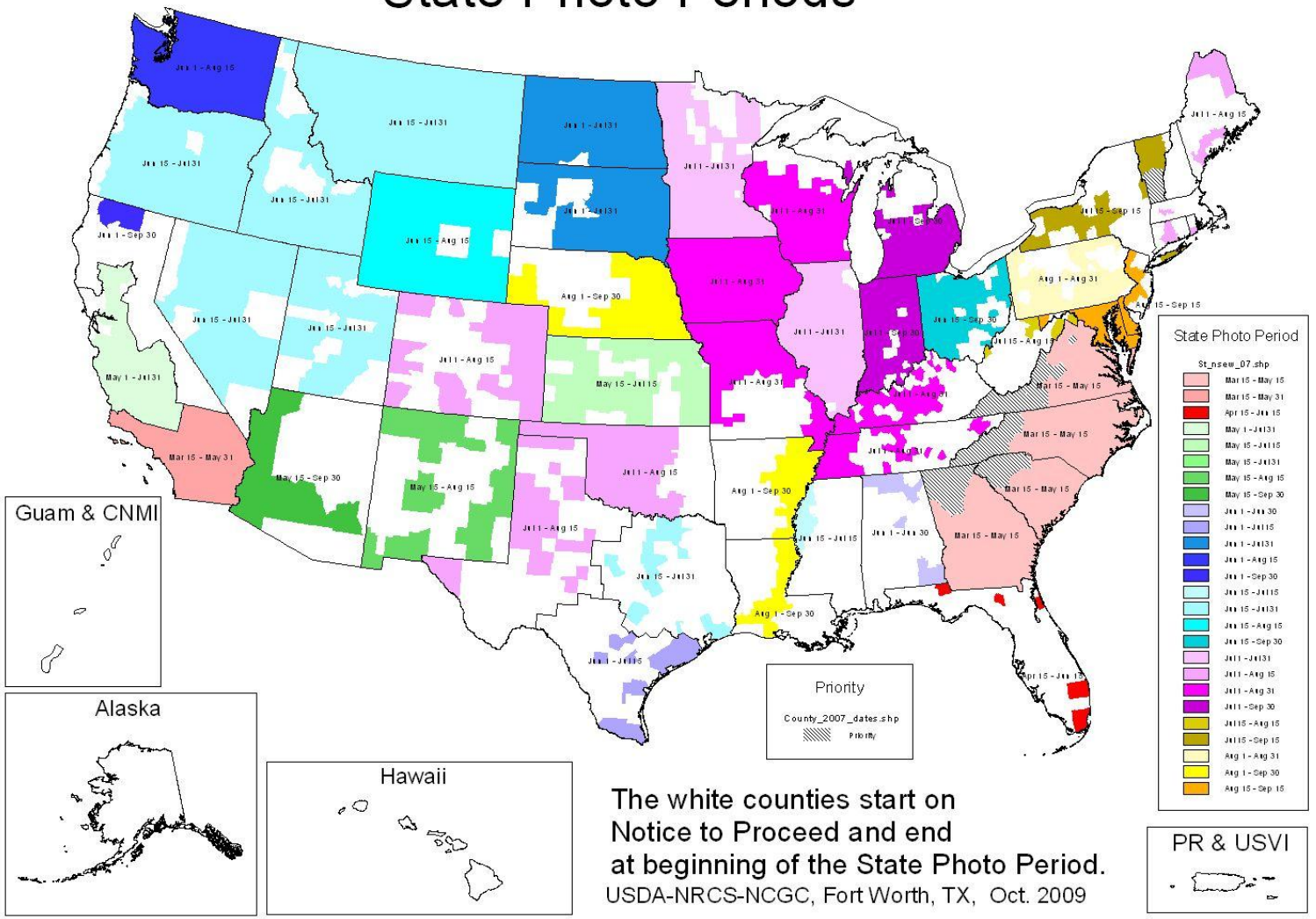


The NRI is a statistical survey of land use and natural resource conditions and trends on U.S. non-Federal lands.

U.S. Department of Agriculture

Natural Resources Conservation Service

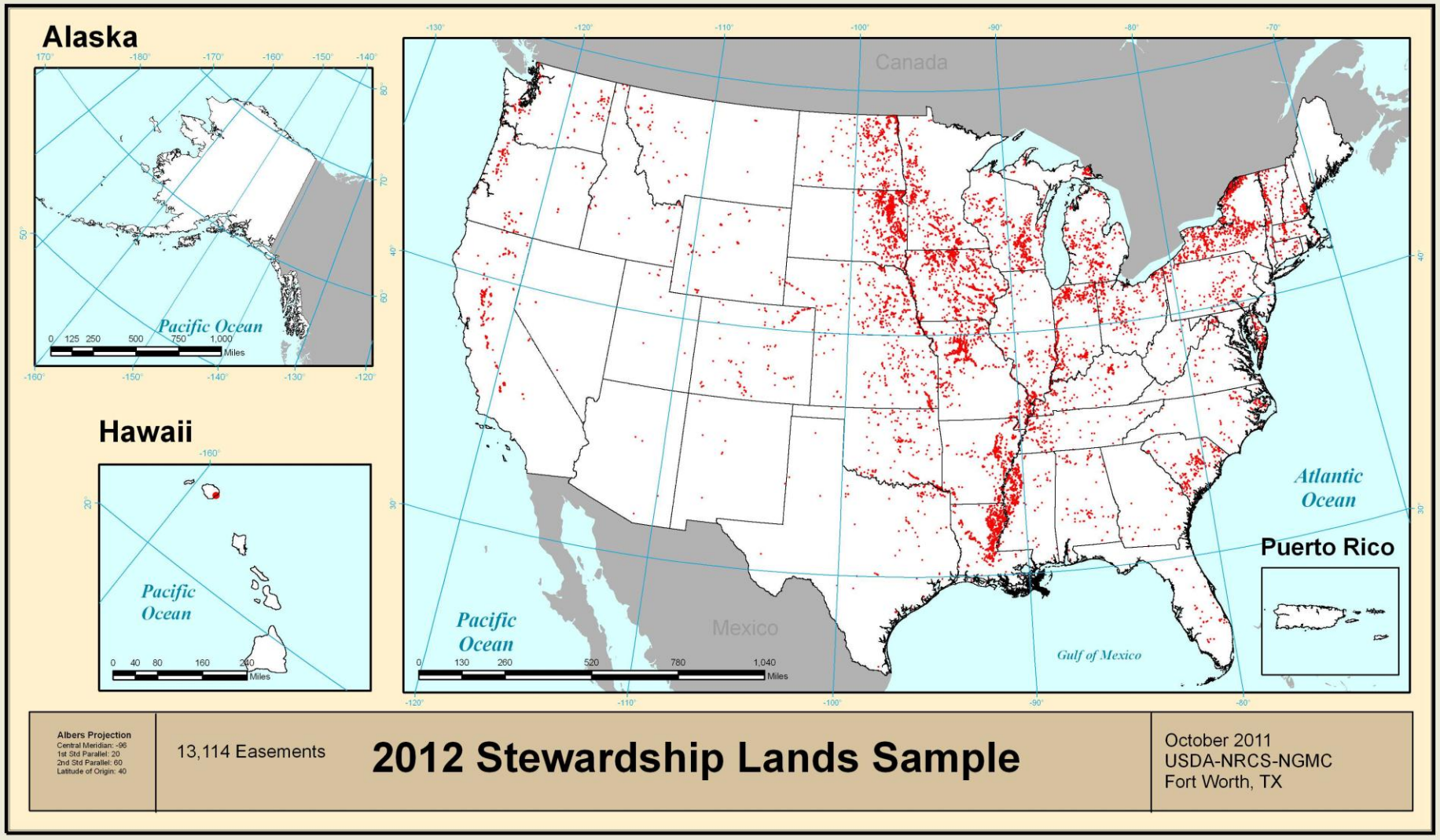
State Photo Periods



The white counties start on
Notice to Proceed and end
at beginning of the State Photo Period.

USDA-NRCS-NCGC, Fort Worth, TX, Oct. 2009

NRI is a 9” x 9” Film Acquisition

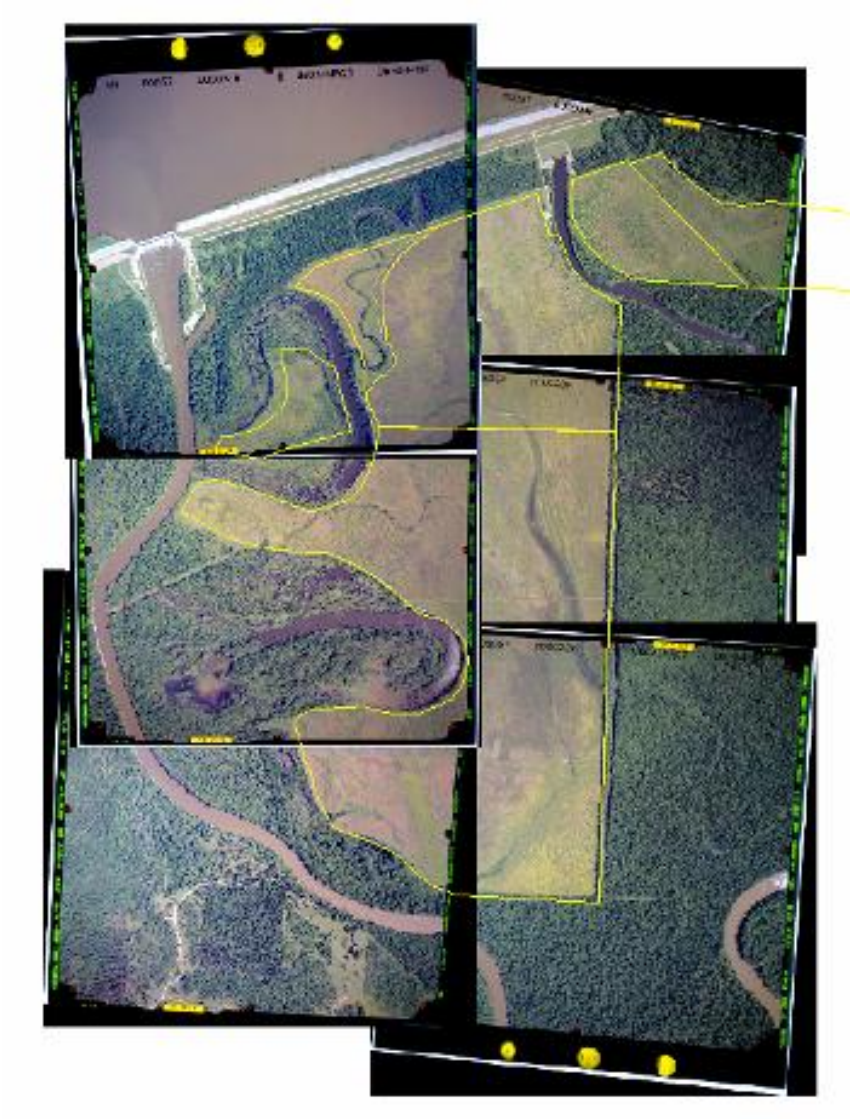


21,811 Photos

Stewardship Lands Photography used for Compliance

Stewardship Lands:

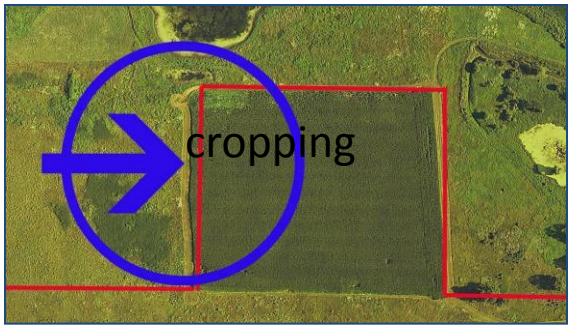
Film ➔ Scanned Orthophotos ➔ Mosaics

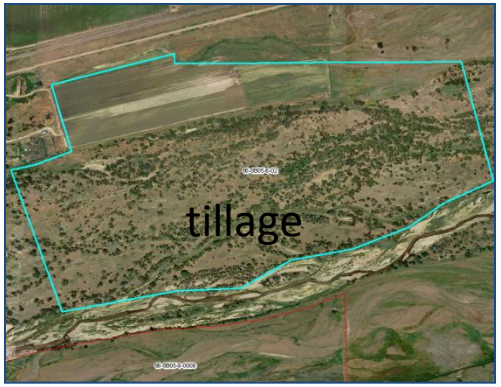


Individual orthorectified SL photos

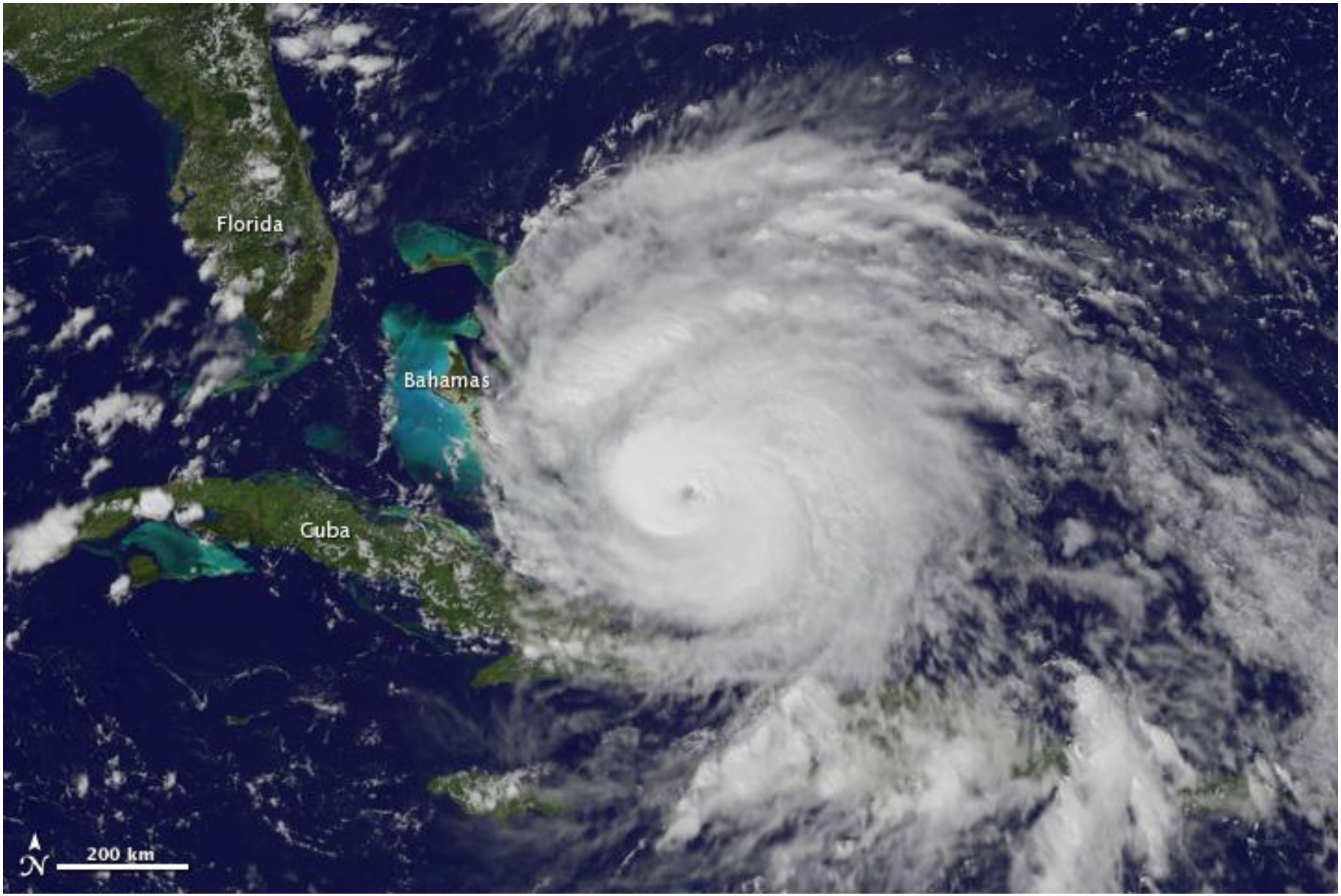
Mosaicked, tone balanced, SL photos

Easement Compliance Violations Discovered and Documented





Disasters



GOES image processed by NASA GOES Scient Team, August 24, 2011,

DISASTER RESPONSE AND RECOVERY IS A MAJOR APPLICATION OF IMAGERY

Fires
Floods
Wind
Hail
Drought
Heat
Tornados

Impact

Crops
Livestock
Trees
Grazing
Honey bees
Soils
Water
Infrastructure

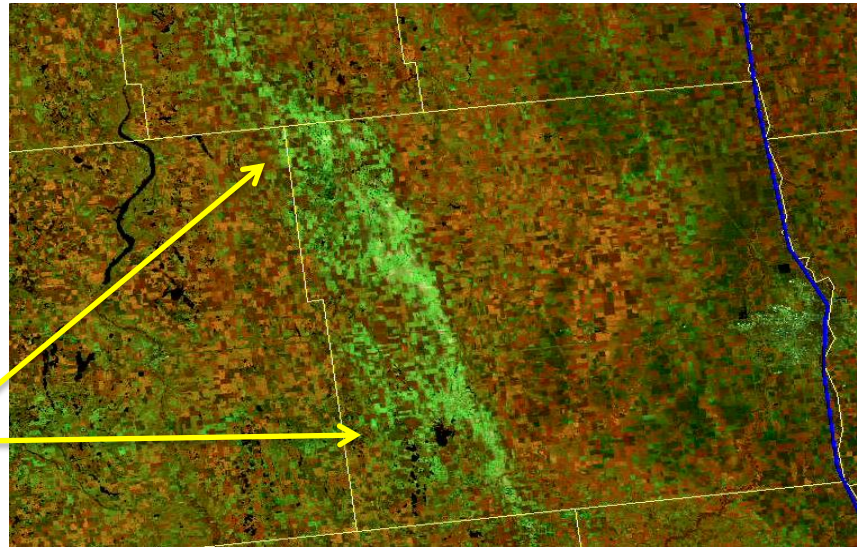
Result

Income Losses
Environmental Impacts

Mitigate

Programs:
Conservation
Insured Losses
Uninsured Losses
Emergency Loans

Hail Damage
Case County, ND



Soybeans outside hail impact

Soybeans after Hail

Presidential Major Disaster Declarations

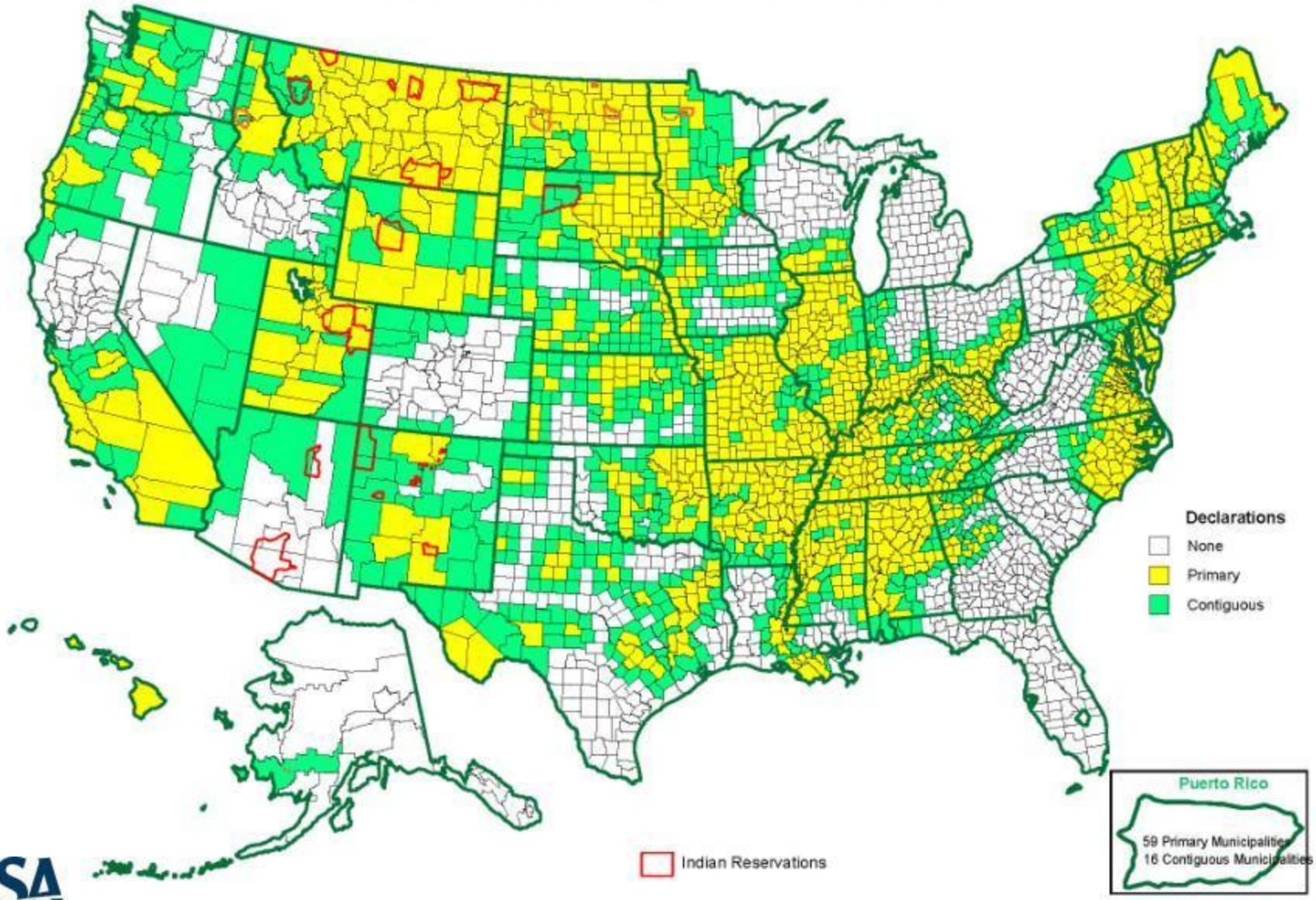
- 2011 Federal Disaster Declarations
  - Major Disaster Declarations 87
  - Emergency Declarations 25
  - Fire Management Assistance Declarations 112
- 2011 set a record for the number of Major Disaster Declarations.

Year	Disaster Declarations
2011	87
2010	81
2009	59
2008	75
2007	63
2006	52
2005	48
2004	69
2003	56
2002	49

PRESIDENTIAL DISASTER DECLARATIONS - CY2011

MAJOR DISASTERS and PRESIDENTIAL EMERGENCIES

Unduplicated Primary & Contiguous Counties: As of 10/12/2011

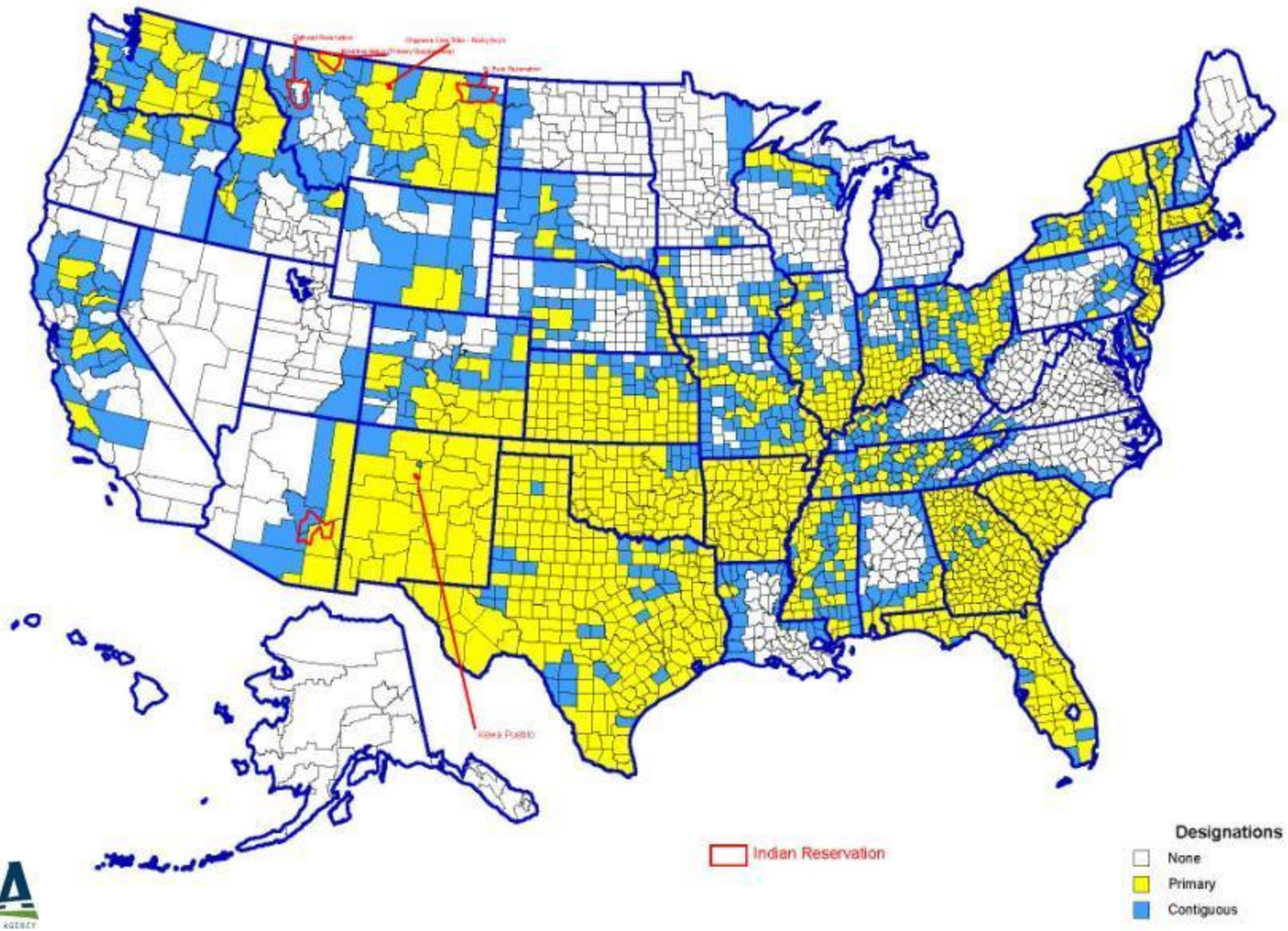


FSA
FARM SERVICE AGENCY

SECRETARIAL DISASTER DESIGNATIONS - CY2011

PRIMARY & CONTIGUOUS COUNTIES DESIGNATED BY THE SECRETARY - USDA:

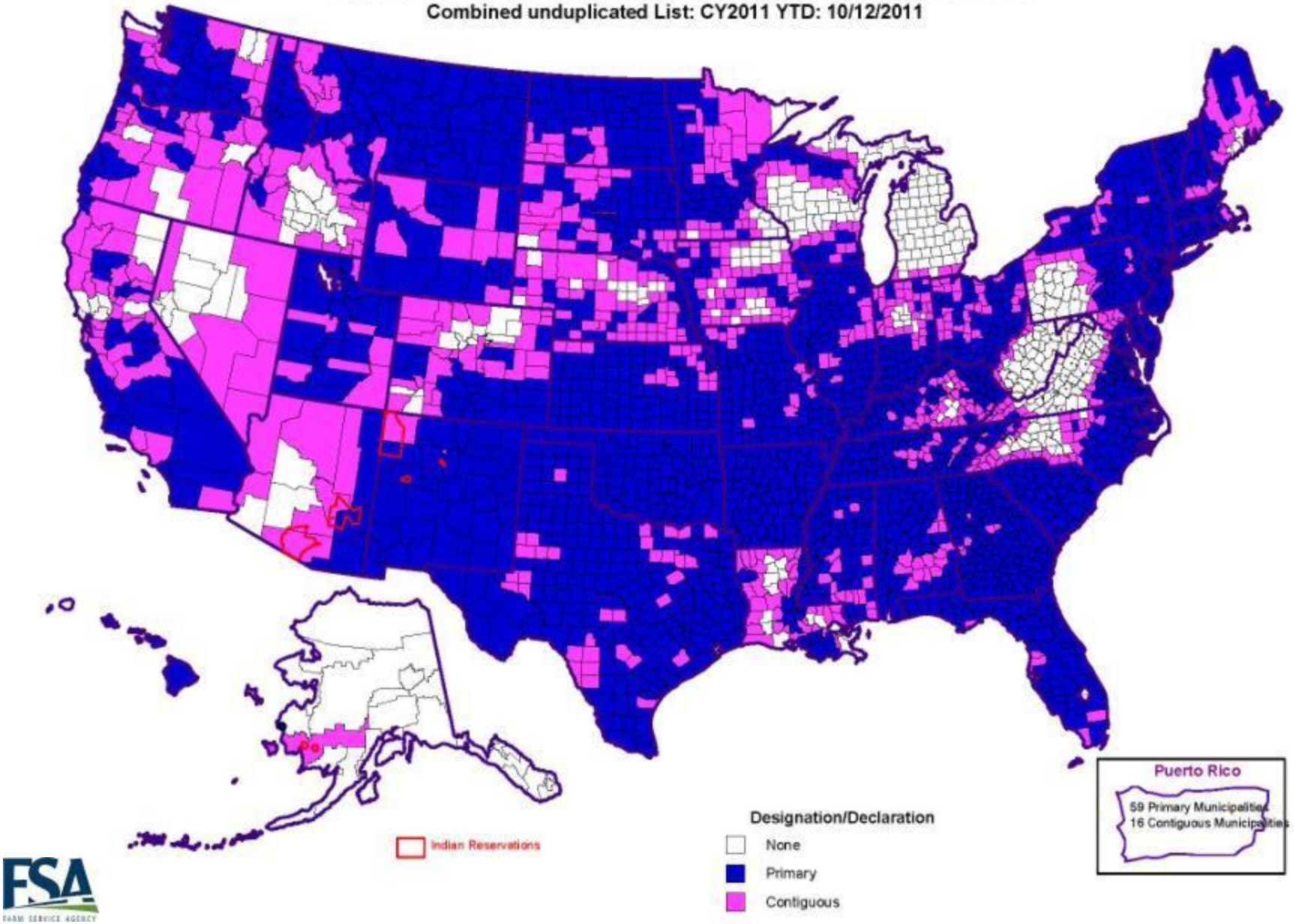
As of 10/12/2011 - through Designation No. S3177 (Approved 10/05/2011)



DISASTER DESIGNATIONS - CY2011

Secretarial & Presidential Disasters PRIMARY & CONTIGUOUS COUNTIES:

Combined unduplicated List: CY2011 YTD: 10/12/2011



FSA

FARM SERVICE AGENCY

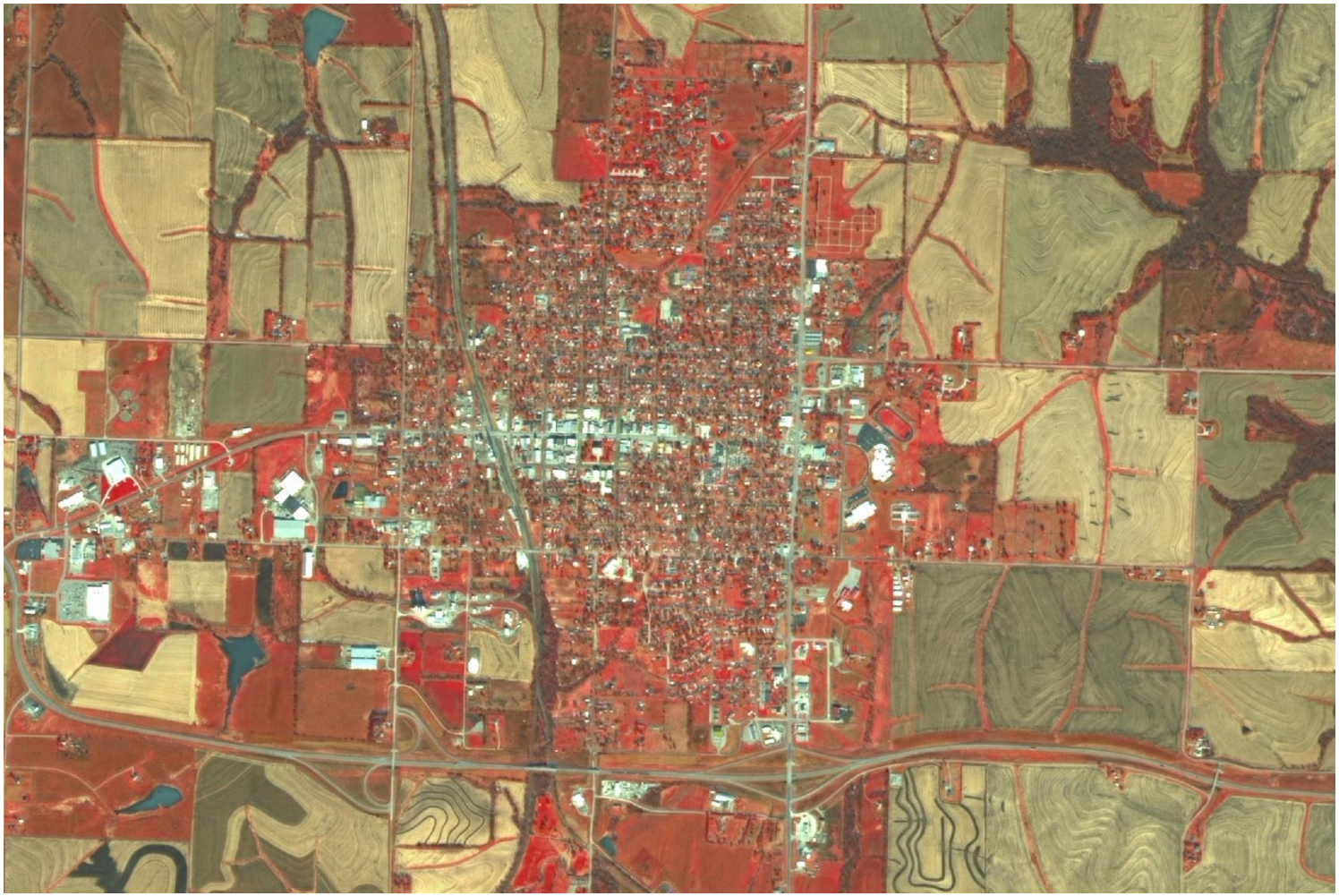
Hurricane Irene

- The USGS Tagged ***6,600*** images related to Hurricane Irene. With ***3,211*** post-event images.

- **US Not Licensed:**
  - ASTER
  - Landsat TM and ETM+
  - EO1
  - Aerial
- **US Licensed:**
  - WorldView
  - GEOEYE
  - IKONOS
  - QuickBird
- **Licensed Foreign**
  - SPOT
  - RapidEye
  - Radarsat
  - TerraSARX
  - COSMO ISA
  - DMC

http://hdds.usgs.gov/hdds2/

Pan Sharpening SPOT for Disaster Recovery Imagery



FSA FARM SERVICE AGENCY

Questions?

Pre-Event Imagery: Microsoft Bing, Post-Event Imagery: Surdex

Joplin, MO